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No. - .

In the
Supreme Court of the United States.

OCTOBER TERM, 1983.

RAYTHEON COMPANY,
PETITIONER,

v.

ROPER CORPORATION,
RESPONDENT.

Petition for Writ of Certiorari to the United States Court of Appeals for the Federal Circuit.

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Petitioner, Raytheon Company, respectfully prays that a writ of certiorari issue to review the judgment and opinion of the United States Court of Appeals for the Federal Circuit entered in this proceeding on December 30, 1983.

QUESTIONS PRESENTED

I. May a patented apparatus be found to have "utility" within the meaning of 35 U.S.C. §§ 101 and 112 where that apparatus is wholly inoperative with respect to the problem which it assertedly solved?

As corollaries to this:

A. May claims to an invention which assertedly achieves an unusual and surprising result be invalidated on a showing of complete failure to achieve that result only when the

result itself is expressly stated in the claims?

B. May a patent be found to have utility under 35 U.S.C. §§ 101, 112 if it possesses utility for some purpose even if that purpose is not the purpose for which the patent was granted?

C. May a court define "the invention" for which a patent was granted solely as a matter of law and without regard to factual evidence concerning the invention and the nature in which it operates?

D. Where a patentee tried its case on the theory that its invention provided certain "surprising results" and the Trial Court, after hearing all the testimony and viewing tests conducted by both parties, found it "inescapable" that

such results were not, in fact, achieved, may the Court of Appeals sua sponte redefine both the invention and the theory on which the case was tried so as to ignore the failure to achieve such results?

II. May a court ignore the statements contained in the explanatory portion of a patent (i.e., the specification), which place in context terms used in the claims, when determining the scope of those claims?

III. May a patent whose claims would otherwise be invalid for lack of utility (35 U.S.C. § 101) nevertheless be upheld by a court because the court refuses to consider such lack of utility once it finds the patent infringed?

IV. May the Court of Appeals for the Federal Circuit set aside the Trial Court's findings as to the nature and operation of the patented invention without regard to the "clearly erroneous" standard of F.R.Civ.P. 52(a) where the findings were supported by the overwhelming weight of both the testimonial and documentary evidence.

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OPINIONS BELOW

The opinion of the United States District Court for the District of Massachusetts is unreported but has been reproduced in the Appendix to this petition at App. B1 - B59.* The opinion of the Court of Appeals for the Federal Circuit is reported at 724 F.2d 951 and 220 U.S.P.Q. 592 and is reproduced at Appendix pages App. B60-B124.

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*The appendix to this Petition is presented in two volumes, labelled Volume A and Volume B, respectively. Volume A is oversized, as it contains patent documents. Pages of the appendix are referred to in the form "App. Xy," where X indicates the volume (i.e., A or B) and y denotes a page number within that volume.

The patent in suit has a "specification" (written description) common to three separate patent applications. To assist the Court, those portions of the specification specific to the invention in question here are highlighted in gray.

JURISDICTION

The U.S. District Court had original jurisdiction of this matter pursuant to 28 U.S.C. §§ 1338(a), 2201 and 2202. The judgment of the Court of Appeals for the Federal Circuit was entered on December 30, 1983. Petitioner's timely petition for rehearing was denied on March 1, 1984 and this petition for certiorari is being filed within 90 days of that date. A copy of the order denying the petition for rehearing is printed in the Appendix at page B125. The jurisdiction of this Court is invoked under 28 U.S.C. § 1254(1).

STATUTES INVOLVED

35 U.S.C. § 101 states:

Whoever invents or discovers any new and useful process, machine, manufacture,

or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

35 U.S.C. § 103 states:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

35 U.S.C. § 112, first and second paragraphs, states:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the

subject matter which the applicant regards as his invention.

FEDERAL RULE OF CIVIL PROCEDURE INVOLVED

Rule 52(a), F.R.Civ.P., states:

> In all actions tried upon the facts without a jury or with an advisory jury, the court shall find the facts specially and state separately its conclusions of the law thereon, and judgment shall be entered pursuant to Rule 58; and in granting or refusing interlocutory injunctions the court shall similarly set forth the findings of fact and conclusions of law which constitute the grounds of its action. Requests for findings are not necessary for purposes of review. Findings of fact shall not be set aside unless clearly erroneous, and due regard shall be given to the opportunity of the trial court to judge the credibility of the witnesses. The findings of a master, to the extent that the court adopts them, shall be considered as the findings of the court. It will be sufficient if the findings of fact and conclusions of law are stated orally and recorded in open court following the close of the evidence or appear in an opinion or memorandum of decision filed by the court. Findings of fact and conclusions of law are unnecessary on decisions of motions under Rules 12 or 56 or any other motion except as provided in Rule 41(b).

STATEMENT OF THE CASE

In response to a letter charging it with infringement of United States Patent No. 4,028,520, issued June 7, 1977 to Sumner H. Torrey for "Air flow System For Common Cavity Microwave Oven" and assigned to the Roper Corporation ("Roper"), Raytheon Company ("Raytheon") brought suit in the United States District Court for the District of Massachusetts for a declaratory judgment of invalidity and non-infringement. After an eight-day trial, the court found the alleged invention to be inoperative and thus held the patent invalid under 35 U.S.C. §§ 101 and 112.

The Court of Appeals for the Federal Circuit affirmed the District Court's decision as to Claim 1. However, it reversed as to Claims 2-7, though they define the same oven structure as

Claim 1, because they use different language in describing the performance of that structure. (App. B81-B89).

The invention, which may be better understood by reading this description in conjunction with the diagram printed at App. B126, relates to so-called "common cavity" or "combination" ovens - i.e., ovens wherein food may be cooked thermally (e.g., using conventional electric resistance elements) and/or by microwaves within the same (i.e., common) cooking chamber or "cavity", and wherein the oven may also be operated in a conventional, pyrolytic self-cleaning mode. (App. B61-B62). In particular, the patented invention is purportedly directed to an improvement in such self-cleaning common-cavity ovens.

The invention covered by the patent in suit is an air flow system for such

ovens. (Col. 1, lines 1-2, 43-44, 48-49 and 55-56).*

Air is supplied to the oven cavity through a part of the microwave energy supply called a waveguide, by way of a hole in the bottom of the oven cavity. The waveguide is simply a metal tube. Microwave energy for cooking is transmitted from a microwave generator to the oven cavity through this tube. The microwave generator is located beneath the oven cavity (App. B67-B69), and the waveguide is connected between the microwave generator and the opening in the oven bottom. (App. B67-B69).

Two types of airflow are involved: during microwave cooking, a fan forces air through the waveguide tube and into

*References to the patent in suit, reproduced at App. A1-A13, will be to column and line, only, rather than to Appendix page, to facilitate location of the appropriate passages.

the oven cavity, to carry off the moisture released by microwave heating (App. B69); during thermal cooking and self-cleaning, the airflow into the oven is convective, being generated by the rising of hot air in the oven cavity. (App. B69).

During microwave operation, the airflow system is identical to that used previously for microwave ovens. (App. B138, B139). In conventional electric self-cleaning ovens, the convective air during cooking and self-cleaning enters through a gap at the bottom of the oven door (col. 7, line 32); in the patented oven, convection air flow during thermal operation passes into the cavity through the same path as is used for entry of forced air during microwave cooking (App. B69) as a natural consequence of locating

the entry point for forced air flow at the bottom of the cavity.

The problem alleged to be solved by the invention is the backing up of oven vapors into the waveguide, from the oven cavity, when the oven is operated in the self-cleaning mode. (Col. 1, lines 5-25). This back-up (also called backflow) was asserted by the inventor to cause fouling of the waveguide and thereby to be deleterious to operation of the microwave supply (App. B140-B141). It results from the increased pressure in the oven cavity caused by "auto-ignition" which accompanies self-cleaning (patent, col. 1, lines 5-25; col. 7, lines 22-33).* The solution of the backflow

*Autoignition is the spontaneous combustion of volatile gases from food residue that occurs from time to time during self-cleaning. The combustion is rapid, in the nature of an explosion, giving rise to a substantial pressure surge in the oven cavity. (App. B142-B143)

problem is the stated goal of the invention is set forth expressly in each of the specific objects recited in the patent (col. 1, lines 26-54) and implicitly in the sole "general" object (col. 1, lines 55-59).

The problem supposedly was solved by placing the open waveguide below the oven cavity (col. 7, lines 22-33) instead of on the sidewalls (as in the prior Boehm patent, App. A23) or on the top as in prior wall-mounted or countertop ovens (e.g., Roper's prior Tingley patent, App. A17, and Raytheon's Amana RR4 oven, App. B127, B144-B147). This was asserted to provide a continuous upward flow of air through the oven cavity and out the vent at the top, even in the face of the pressures developed by autoignition, so that back-up of decomposition products into the waveguide is thereby prevented

(col. 7, lines 22-33). This structure (i.e., placement of an open waveguide below the oven cavity, with convective air flowing through it during self-cleaning) purportedly solved the backflow problem and was incorporated in every claim of the patent.

At trial, Raytheon established that both the Roper and the Raytheon ovens (the one being asserted to embody the patented invention, the other accused of infringement) suffer backflow into the waveguide during self-cleaning. (App. B35-B36).

Accordingly, the District Court held the patent invalid as lacking utility under 35 U.S.C. §§ 101 and 112.

The Trial

The District Court found that the case was tried by Roper on the theory of

operation set forth in the patent, namely, (1) that backflow into the waveguide caused by autoignition pressures arising during self-cleaning was a serious problem in self-cleaning and (2) that backflow is, indeed, prevented by the oven described in the patent. (App. B44).

This was based directly on Roper's opening statement (App. B148-B149, B150-B151) and on the inventor's own testimony (e.g., Ap. B152-B153). The inventor testified that the patent was explicitly directed to solving the problem of backflow of oven vapors into the waveguide (App. B154-B155); that the consequences of allowing such backflow were extremely serious (App. B156, B157, B140-B141); and that the oven would not function effectively without an effective means for preventing backflow into the

waveguide during self-cleaning (App. B158).

The inventor claimed to have solved a "dilemma" posed by the prior art (App. B159, B160-B161) by placing the waveguide at the bottom of the oven cavity to allow convected air to pass through it during self-cleaning (App. B162-B166) as described in the patent (col. 7, lines 22-33).*

Roper asserted that autoignition backflow, and thus fouling, was thereby prevented, either because a counter-vailing back pressure was created by the convective air flow through the waveguide (App. B167) or simply because the air entry was limited and the waveguide

*Actually, as Triplett, Roper's Vice President of Engineering explained it, the waveguide was placed at the bottom of the oven because that was the most convenient and economical location because of the available space. (App. B136-B137).

formed a pressure chamber which prevented backflow from the oven (App. B168). In response to a direct question from the Court, the inventor represented that backflow was prevented by the convective air flow (App. B169-B172) and that this provided a positive resistance to autoignition back pressure (App. B173-B174).* Although he admitted the total implausability of this assertion because of its apparent violation of the laws of physics (App. B175-B177, B178-B179), he persisted in his assertion that his invention does prevent backflow and consequent fouling (App. B180-B181).

*By "resistance" the inventor testified that he meant sufficient resistance to prevent backflow (App. B154-B155, B167, B173-B174, B180-B181), which is the mechanism through which fouling allegedly occurs (App. B152-B153, B184-B191).

The District Court rejected this testimony and expressly found that the convected air can not and does not resist the autoignition pressure which gives rise to backflow (App. B35-B36), and thereupon invalidated the patent. (Id.).

Review by the Court of Appeals

In reversing the District Court as to claims 2-7, the Court of Appeals stated that the trial court "legally erred in interpreting claims 3 and 4" (App. B81), and erred as to claims 2 and 5-7 in finding that prevention of "explosive reactions", as specified in those claims, is equivalent to prevention of "autoignition" (App. B87-B88).

The Court of Appeals further ruled that claims 2-7 meet the utility requirements of § 101 because (1) the invention set forth in those claims (as

that court interpreted the claims) meets a single broadly stated objective of the invention (App. B91-B92); (2) claims 2-7, unlike claim 1, do not explicitly recite the stated objective of preventing backflow; and (3) the finding of infringement mandates a finding of utility. (App. B93-B95). The court also concluded that claims 2-7 were not invalid under § 112.

REASONS FOR GRANTING THE WRIT

I. The Decision Below Rests Upon an Erroneous Interpretation of a Prior Decision of this Court With Respect to the Nature of the Utility Required of Patentable Invention.

A. The Decision Below is Erroneous In Holding That an Invention Satisfies the Utility Requirements of 35 U.S.C. §§ 101, 112 If It Possesses Utility for Some Purpose Even if Such Purpose is Not the Purpose for Which the Patent was Granted.

The statutory requirements for utility are set forth at 35 U.S.C. §§101,

112. It has long been established in this Court that, in order to possess the requisite utility, an invention must be operable for its intended purpose, Mitchell v. Tilghman, 86 U.S. 287, 396, 397 (1873). The intended purpose is a question of fact or, at the very least, a mixed question of fact and law, to be determined from consideration of the patent specification, the statement of the problem to be solved, the description of the asserted solution, the state of the prior art and its relation to the invention in question, and other like factual questions. United States v. Adams, 383 U.S. 39 (1966); Mitchell v. Tilghman, supra.

In conflict with the decisions of this Court in Mitchell v. Tilghman, supra; O'Reilly v. Morse, 56 U.S. (15 How.) 62 (1853) and Beidler v. United

States, 253 U.S. 447 (1920), among others, the Court of Appeals in the instant case has held that an invention is "useful" within the meaning of the statute, 35 U.S.C. §§ 101, 112, if it can be used for any object stated in the patent specification (App. B91), whether or not that object has anything to do with the problem which the invention assertedly solved and for which the patent was granted.

To reach this result, it found, contrary to the express findings of the District Court based on all the evidence, that the invention was not an airflow structure that prevented backflow, as asserted by Roper, but simply an airflow structure that worked without exploding, whether or not it prevented backflow. In so construing the patent, and thus saving it from the invalidity that would

otherwise follow from the District Court's finding of complete and total inoperability, it dismissed the entire teachings of the patent, as well as the inventor's own damaging testimony as to it, as merely an erroneous "theory of operation". Further, it misconstrued the phrase "useable in all three modes" as wholly independent of the specifically stated purpose, i.e., an oven useable in all three modes without backflow, and thus fouling, in the self-cleaning mode.

The sole object which the Court of Appeals found "satisfied" by the invention as so redefined was one also met by every self-cleaning oven on the market prior to the time of the alleged invention, and every self-cleaning oven on the market since that time, including the prior art ovens (e.g., GE combination ovens) over which Roper claimed to have

made an advance. Every such oven has a ventilating system "useable in all three modes of operation", "safe in all three modes", and free of "risk of violent explosion of the products of combustion in the self-cleaning mode."

By thus disassociating the statutory command that an invention must be "useful" (35 U.S.C. § 101), from the purpose for which the invention must be useful (i.e., solution of the problem stated to be solved by the invention), the Court of Appeals departed from a consistent understanding of this Court as to the nature of the "utility" that an invention must possess to be patentable.

In O'Reilly v. Morse, 56 U.S. (15 How.) 62, 119 (1853) the requisite utility was specifically described:

> Whoever discovers that a certain useful result will be

> produced, in any art, machine, manufacture, or composition of matter, by the use of certain means, is entitled to a patent for it; provided he specifies the means he uses in a manner so full and exact, that any one skilled in the science to which it appertains, can, by using the means he specifies, without any addition to, or subtraction from them, produce precisely the result he describes. And if this cannot be done by the means he describes, the patent is void. (emphasis added)

And in Beidler v. United States, 253 U.S. 447, 453 (1920), the principle was similarly stated:

> Ever since Grant v. Raymond, 6 Pet. 218, 247, it has been consistently held that a correct and adequate description or disclosure of a claimed discovery (which, in the case of a machine, involves particularly the operation of it) is essential to the validity of a patent, for the reason that such a disclosure is necesssary in order to give the public the benefit of the invention after the patent shall expire... .
>
> The application of these requirements of the law to our conclusion that the only form of construction of the machine

> and the only method of operation of it which are disclosed in the patent would not produce a sufficiently uniform and rapid development of the film to render it useful, must result in the approval of the judgment of the Court of Claims, that the patent is invalid and void, for the reason that it fails to disclose a practical and useful invention. (Emphasis added).

The same principles were applied in Murton v. Ladd, Comr., Pats., 352 F.2d 942, 944 (D.C.Cir. 1965) which held the sole asserted claim invalid as being too broad because "it is not limited to a structure essential to accomplish the advantage claimed for the invention". The dissenting opinion of Circuit Judge Burger in that case would have sustained the claim on the ground that there was expert testimony that one skilled in the art would construe claim 2 as necessarily directed to structure achieving the stated advantage. Thus, whether the

advantage assertedly provided by the invention was to be found in the specification or whether it was to be found in the claim, the court clearly held that the claim must be interpreted as directed to a structure providing that advantage and, if it could not be so interpreted, it is invalid.

B. The Decision Below Is Erroneous In Holding That the Utility of an Invention to Solve the Problem Posed in the Patent is Not to Be Considered In Construing a Claim of the Patent Unless That Utility Is Expressly Stated in Such Claim.

In holding that a patented invention need not possess the utility asserted for it in the specification, the Court of Appeals confined Mitchell v. Tilghman, 86 U.S. 287 (1873) to cases where the asserted utility is expressly set forth in the claims. (App. B90-B91). Accordingly, it affirmed the District

Court's invalidation of claim 1, which expressly set forth the performance purportedly achieved by the invention, namely, convected air flow uninterrupted by backflow:

> ...so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected from the blower inlet through the air passages into the waveguide and into the cavity for exiting through the cavity air vent...(Claim 1, Col. 11, lines 41-45)

even in the presence of autoignition:

> ...notwithstanding the autoignition pressure which exists in the cavity under high temperature self-cleaning conditions...(ibid., lines 45-48).

However, the Court of Appeals reversed the District Court's finding of invalidity as to claims 2 - 7 solely on the ground that those claims did not expressly recite that performance. (App. B91-B92), even though all of the claims

do in fact define essentially the same structure (see App. A14-A16):

> ...the blower inlet being located at a leve[l] below the bottom wall of the cavity... (Claim 1, col. 11, lines 39-41)

and, according to the patent specification (col. 7, lines 22-29), it is this very structure which provides the asserted performance.

1. The Standard Established by the Court of Appeals for Construing a Patent Ignores the Requirements of the Patent Statute Found in 35 U.S.C. § 112 and Contravenes Prior Decisions of This Court.

Section 112 of the patent statute, Title 35 U.S. Code, requires a written description (i.e., a "specification") of the invention that is sufficiently clear and concise as to teach those skilled in the art how to make and use the invention. This section also requires one or more claims defining what the inventor believes he has invented. The

most important task confronting any court in dealing with patent issues is defining just what that "invention" is and determining whether or not it meets the statutory standards.

The principle is well established in this Court that, in ascertaining the nature of an invention, one must construe not the claims standing alone, but, rather, the patent as a whole:

> ...it is fundamental that claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention.

United States v. Adams, 383 U.S. 39, 49 (1966)(emphasis added). To the same effect is Schriber-Schroth Co. v. The Cleveland Trust Co., 311 U.S. 211 (1940):

> The claims of a patent are always to be read or interpreted in the light of its specifications...(emphasis added).

In interpreting claims, resort must be had to the specification, even where the

claims, without such reference, would appear to read directly on the accused device. Graver Tank and Mfg. Co., Inc. v. Linde Air Products Co., 339 U.S. 605 (1950), stated that:

> Consideration must be given to the purpose for which an ingredient is used in a patent, the qualities it has when combined with the other ingredients, and the function which it is intended to perform.

339 U.S. at 609 (emphasis added).

2. The Standard Established By The Court of Appeals for Construing A Patent Rewards and Encourages Sharp Patent Practice.

In addition to instructing those skilled in the art as to the nature of the invention and the manner of using it, the specification also serves to inform the patent examiner, who has the initial responsibility of determining patentability, as to just what the invention is. The examiner, as are the courts, is

required to consider "the specification as a whole". Application of Long, 368 F.2d 892, 895 (C.C.P.A. 1966). He is to interpret the claims in the light of the whole specification:

> Nor can we agree with appellants' position, that only Barrett's claims constitute evidence of what Barrett invented. It is true that appellants are correct in noting that it is the claims which define "the subject matter which the applicant regards as his invention." 35 USC 112 (second paragraph.) However, it does not follow from this that the specification should be ignored in determining what a patentee invented. To the contrary, it is a fundamental principle of patent law "that claims are to be construed in the light of the specifications and both are to be read with a view to ascertaining the invention." United States v. Adams, 383 U.S. 39, 49, 148 USPQ 479, 482 (1966). [Emphasis added]

In re Clemens, Hurwitz and Walter, 622 F.2d 1029, 1037 (C.C.P.A. 1980).

Unless statements in the specification are wholly implausible on their face, if the examiner has no factual basis for rejecting them he must accept them at face value:

> As a matter of Patent Office practice, then, a specification disclosure which contains a teaching of the manner and process of making and using the invention in terms which correspond in scope to those used in describing and defining the subject matter sought to be patented must be taken as in compliance with the enabling requirement of the first paragraph of § 112 unless there is reason to doubt the objective truth of the statements contained therein which must be relied on for enabling support.

Application of Marzocchi, 439 F.2d 220, 223 (C.C.P.A. 1971).

Such statements are frequently given significant weight in assessing patentability:

> ...known disadvantages in old devices which would naturally

> discourage the search for new inventions may be taken into acount in determining obviousness.

United States v. Adams, 383 U.S. 39 (1966).

To hold, when interpreting the claims, that the patentee may tout such advantages in the specification as evidence of unobviousness, 35 U.S.C. § 103, in order to convince the Patent and Trademark Office to grant a patent, but may avoid being burdened by such assertions so long as they are not expressly incorporated into the claims, is to import into patent law the standards of Madison Avenue hucksterism: "Promise Her Anything, But Give Her Arpege". In particular, if this decision is allowed to stand, it will provide a clear message to patent applicants: one may, without facing any consequences, promise or represent anything in the

specification so long as one avoids sealing that promise into the claims.

The instant case is an excellent illustration of just such an occurrence. If the patentee had described only the structure of his oven, and had not asserted for it the unique ability to prevent backflow despite autoignition, his application would have been rejected by the Examiner under Anderson's-Black Rock, Inc. v. Pavement Salvage Co., 396 U.S. 57 (1969) as being a combination of old elements - a microwave oven and an electric self-cleaning oven - whose result is assuredly no greater than the sum of its parts. However, the patentee asserted the existence of a serious problem (fouling of an open waveguide due to backflow during autoignition) purportedly solved by the oven combination, even though he was aware of

the results of the Underwriters' Laboratories test at that time showing that the structure did not prevent backflow during self-cleaning (App. B28). The inventor even asserted at trial that he was "surprised" by the results and that he would not have believed it operated and, indeed, right through trial purported to be at a loss to understand how it did so.

The Examiner accepted the patent's assertions at face value, as he was bound to do, and allowed the application on the very first Office action without further examination. By omitting the asserted function of the invention from one or more of the claims of the application, and by including in the application a single general "object" of the invention that reads on any and every self-cleaning microwave oven ever placed on the market

before or since ("safe" and "useable in all three modes" without "risk of violent explosion"), the patentee has, unless this Court repudiates the doctrine announced by the Court of Appeals, thereby created an impregnable patent position for an "invention" that has never worked, never will, and is clearly substandard under under any rational criterion.

There is no basis here for sustaining any of the claims of the Roper patent.

II. In Holding That There Is Estoppel To Deny Utility Once Infringement is Found, The Court of Appeals Has Effectively Read 35 U.S.C. § 101 Out of the Patent Statute.

In Lehnbeuter v. Holthaus, 105 U.S. 94 (1881), the court considered a design patent on a merchandise showcase. After noting that the issuance of a patent is

prima facie evidence of both novelty and utility, and that neither presumption had been rebutted by the evidence, the court held:

> The fact that it has been infringed by defendants, is sufficient to establish its utility, at least as against them.

105 U.S. 94, 96, 97.

Whether in fact the court meant "utility" as now defined under 35 U.S.C. 101, 112 is open to question, since the concept has almost no meaning with respect to a design patent. Further, in stating that the presumption of novelty and utility had not in fact been rebutted by the evidence, the court clearly indicated that it had received and considered evidence on these points.

With the exception of a few cases in the Sixth Circuit, the theory of estoppel by infringement seems to have passed away

relatively unnoticed. Recently, however, it was resurrected by Judge Markey in E.I. DuPont De Nemours v. Berkley & Co., 620 F.2d 1247 (8th Cir. 1980) and again in the instant case.

From the manner in which the few courts treating the issue have applied it, the doctrine may well in fact be one of evidentiary weight, as opposed to estoppel. Thus, to the extent that the doctrine merely stands for the proposition that one who has been found to infringe will be treated with skepticism in asserting that the invention found to be infringed was without value, the doctrine would not appear to be improper and, in a given case, might be wholly appropriate. In such cases the assertion of "non-utility" is not an attack on utility vel et non but, rather, an attack on the degree or

amount of utility. In those cases, it is implicitly conceded by the infringer that the invention has some utility for its intended purpose (that is, that the invention is operable in the sense of 35 U.S.C §§ 101, 112) and the only dispute is as to the degree of usefulness.

In the instant case, in contrast, the dispute is not as to the degree of operability but, instead, as to the very question of whether there is any operability whatsoever. In particular, it was shown to the satisfaction of the District Court, to a degree that court characterized as "inescapable", that the patented airflow structure was wholly incapable of serving its intended purpose to any degree whatsoever, that is, it was wholly inoperable and thus lacked utility under 35 U.S.C. §§ 101, 112. In such a case, an estoppel to deny utility, i.e.,

operability, has no place in patent law, since the accused infringer is not deriving the asserted benefits of the invention.

To hold otherwise is to read the requirements of utility out of the law, since the only person having an interest sufficient to raise the question of utility after the patent is issued is an accused infringer. If no infringement is found, the question of utility need not be raised or, if raised, is not essential to decision. Only if infringement is found is it necessary to decide the question of utility, and it is precisely in that instance in which the Court of Appeals would estop the infringer to deny the utility.

It was this kind of situation tht led the Supreme Court, in Lear v. Adkins, 395 U.S. 653 (1969) to abolish the

doctrine of licensee estoppel. This Court ought not to countenance the creation of a new doctrine of estoppel to foreclose one accused of infringement from doing what the court in Lear found was essential to allow to those accused of infringement, namely, assert legitimate statutory defenses.

Moreover, the Court of Appeals' application of estoppel conflicts with Mitchell v. Tilghman, 86 U.S. 287 (1873), in which this Court considered the question of utility before dealing with infringement. The Court clearly, therefore, regarded the issue of utility as independent of , and unconstrained by, infringement considerations.

III. The Decision of the Court Below Establishes a Scope of Review of Findings of Fact of Such Breadth as to Be Essentially Unrestrained by Statute, The Federal Rules of Civil Procedure and Prior Decisions of This Court.

On the premise that the "invention" which is the subject of a patent grant is to be ascertained solely with reference to the claims (App. B84-B85), and that claim interpretation is strictly a question of law for the appellate court (id.), the Court of Appeals swept aside the findings and conclusions of the trial court regarding the nature of the patented invention and its meaning to one skilled in the art. It held this evidence to be totally irrelevant to the issue, and its review to be free of the "clearly erroneous" standard for evaluating findings of fact (App. B76-B78, B83-B85). Thus unfettered by the District Court's unquestionable findings, it then redefined the invention in a manner

contrary to the express teachings of the patent and to the testimony of the witnesses, including the inventor himself. In so doing, that Court turned away from nearly two centuries of precedent in this Court.

The mischief that will follow from this decision, if left standing, is not confined to this particular case. The Court of Appeals for the Federal Circuit is now the final authority for patent adjudication, save for this Court. The decisional principles it establishes in the field of patent law bind every court throughout the United States, subject only to review in this Court. The decision here effectively emasculates the role of the Trial Courts in patent cases. It makes the concept of the "trial" of a patent case nothing more than a "dry run" in preparation for argument before the

Court of Appeals and reduces the fact-finding role of the Trial Court to utter insignificance.

A. The Court of Appeals Erred in Disregarding the Trial Court's Findings As to the Nature and Mode of Operation of the Patented Invention.

Patent claims and specifications are addressed to those skilled in the art, 35 U.S.C. § 112, and testimony from such persons concerning the nature of the invention, its scope, Continental Paper Bag Co. v. Eastern Paper Bag Co., 210 U.S. 405, 416 (1908), its mode of operation, and the manner in which it distinguishes from the prior art, Graham v. John Deere Co., 383 U.S. 1 (1966), is frequently helpful and sometimes essential. The weight to be given this testimony is a matter largely within the discretion of the trial court and trial

court findings based on that testimony are to be set aside only if they are "clearly erroneous". F.R. Civ. P. 52(a).

The trial court found that the invention related to the prevention of backflow and attendant waveguide fouling during self-cleaning (App. B35-B36, B44-B46). The solid evidentiary basis on which it made these findings is set forth above at pages 20-23.

Here, the Court of Appeals did not even purport to find that the trial court's findings as to the nature of the invention and its mode of operation (specifically, its utter <u>failure</u> to operate) were "clearly erroneous"; nor could it, in light of the overwhelming factual support on which these findings were based. Instead, that court merely dismissed those findings as <u>irrelevant</u> with respect to claim construction,

holding that "Claim interpretation is a legal matter subject to review free of the clearly erroneous standard applicable to fact findings." (App. B77). In support of this decision, it cited no authority other than its own prior recent holding to that effect.

This Court has recently reiterated the applicability of Rule 52(a) not only to what are frequently called "subsidiary" facts (in patent cases, such facts would be, for example: the state of the art at the time the invention was made, the level of skill in the art, and the manner in which the patented and accused devices operate), but also to so-called "ultimate" facts (in patent cases, these would comprise the questions of novelty, utility, and obviousness):

> Rule 52(a) broadly requires that findings of fact not be

> set aside unless clearly erroneous. It does not make exceptions or purport to exclude certain categories of factual findings from the obligation of a court of appeals to accept a district ccurt's findings unless clearly erroneous. It does not divide facts into categories; in particular, it does not divide findings of fact into those that deal with "ultimate" and those that deal with "subsidiary" facts.

Pullman-Standard v. Swint, 456 U.S. 273, 72 L.Ed.2d 66,79, 102 S.Ct. 1781 (1982). To the same effect is Graver Tank, supra, which specifically noted the especial applicability of Rule 52(a) to patent cases.

The Court of Appeals' total disregard of the District Court's findings in the instant case wholly contravened this standard. Regardless of who makes the "ultimate" findings, whether jury, trial court or appellate court, the subsidiary findings on which

the ultimate findings are based can be disregarded only if they are clearly erroneous.

The District Court's findings that the invention was asserted by Roper to be an oven useful in all cooking modes (thermal, microwave, and self-cleaning) which operated to expel decomposition products during self-cleaning operation (App. B28-B29) and, specifically, a ventilation system for such an oven which resisted backflow from autoignition and therefore prevented contamination of the waveguide (id.) were based not simply on reading the patent itself but were the inevitable result of the eight days of testimony before that Court. The trial court based these findings not only on the patent documents, but also on the positions taken by Roper and the testimony of Roper's witnesses:

> Roper seems to agree that the prevention of backflow and fouling is the key to the invention and submitted tests to show the patent was effective in accomplishing those objectives.

(App. B44) and

> According to Roper, there is no waveguide fouling because there is no backflow.

(App. B45).

Especially germane to the District Court's findings on these issues were the testimony of the inventor, as well as Roper's Trial Brief, Opening Statement, and Response to Raytheon's Request for Admissions.

The testimony of the inventor is set forth above at pages 20-23. Moreover, this characterization of the invention, and its asserted operation was consistent with the arguments of Roper counsel. In their trial brief, counsel expressly characterized "the problem" as pressure

surges caused by autoignition which can carry volatile decomposition products back from the oven cavity into the waveguide (App. B128-B130). The seriousness of allowing decomposition products into the waveguide was emphasized (id.). The "dilemma" this poses for the designer (giving up self-cleaning or risking dangerous contamination of the waveguide) was also asserted (App. B131).

Finally, as the solution to the "problem", Roper stated that the inventor found that by positioning the microwave feed system below the oven cavity and allowing natural convective air to flow through it during both thermal cooking and self-cleaning, the inventor found that the waveguide would not be fouled by "normal" autoignition pressures during self-cleaning (App. B162-B166). This was

asserted to come as a "complete surprise" to the inventor. (Ibid.).

Roper's opening statement repeated these assertions, arguing that the "fouling" which was to be prevented was that arising from backflow into the waveguide caused by autoignition. (App. B182, B183). And Roper's response to Raytheon's Request for Admission unequivocally asserted that in Roper's common cavity oven: "...such backflow is prevented, so that fouling does not occur, in normal self-cleaning even if autoignition does occur." (App. B135).

Thus the Court's finding as to the nature of the invention, and its operation were supported not only by substantial evidence but by overwhelming evidence. In fact, Roper even introduced at trial the results of tests it had run which it offered in support of its

assertion that its oven did not evidence backflow despite autoignition (App. B30).

In support of a contrary definition of the invention, the Court of Appeals ignored all this and pointed to but a single general "object" which it interpreted in a vacuum to find an "invention" having nothing to do with backflow (App. B91-B92). Further, The Court of Appeals suggested an apparent independence between backflow, on the one hand, and contamination or fouling of the waveguide, on the other (App. B85-B86); it purported to glean this independence solely from Roper's opening statement.

This is a far cry from the analysis of the trial record that the Court of Appeals should have undertaken to apply a "clearly erroneous" standard to the Trial Court's findings. Indeed, the evidence

provided by Roper itself compelled the District Court's findings.

B. The Court of Appeals Erred In Failing to Apply a Clearly Erroneous Standard To the District Court's Finding That Roper Tried the Case on the Basis of Backflow Prevention

In refusing to confine Roper to the basis it urged on the Trial Court, the Court of Appeals (App. B85-B86) clearly erred in rejecting the Trial Court's finding that Roper had tried the case on the basis of backflow prevention (App. B44). We have cited above only part of the Roper assertions and testimony to this effect. But even this provides more than ample support for the District Court's findings.

Accordingly, whether an appeal estoppel is imposed on Roper or the Roper trial case is taken as an admission, the result is the same: the nature of the

invention is supression of backflow and the patent claims, which are supposed to define the invention, must be construed accordingly. The claims are therefore all invalid for inoperativeness.

CONCLUSION

For the foregoing reasons, this Court should grant a Writ of Certiorari to review the judgment of the Court of Appeals for the Federal Circuit.

Respectfully submitted,

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ALEXANDER L. STEVAS,
CLERK

83-2128

No. - .

In the
Supreme Court of the United States.

OCTOBER TERM, 1983.

RAYTHEON COMPANY,
PETITIONER,

v.

ROPER CORPORATION,
RESPONDENT.

Appendix A.

ROBERT A. CESARI,
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PETITION FOR WRIT OF CERTIORARI TO THE
UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

APPENDIX

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EDITOR'S NOTE

THE FOLLOWING PAGES WERE POOR HARD COPY AT THE TIME OF FILMING. IF AND WHEN A BETTER COPY CAN BE OBTAINED, A NEW FICHE WILL BE ISSUED.

United States Patent [19]

A1

Torrey

[11] **4,028,520**

[45] **June 7, 1977**

[54] **AIR FLOW SYSTEM FOR COMMON CAVITY MICROWAVE OVEN**

[75] Inventor: **Sumner H. Torrey, West Lafayette, Ind.**

[73] Assignee: **Roper Corporation, Kankakee, Ill.**

[22] Filed: **Feb. 26, 1976**

[21] Appl. No.: **661,524**

[52] U.S. Cl. ..... **219/10.55 B; 219/10.55 F**

[51] Int. Cl.[2] **H05B 9/06**

[58] Field of Search ..... 219/10.55 B, 10.55 F, 219/10.55 R, 126/273 R, 19 R; 343/731, 732, 741, 772, 879

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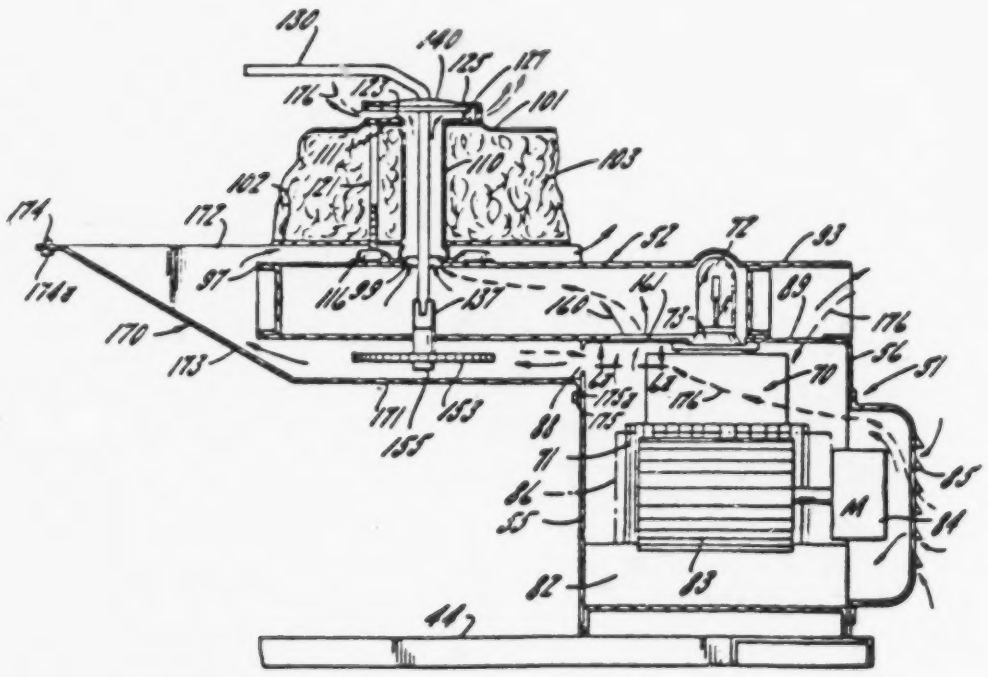
Primary Examiner—Arthur T. Grimley

Attorney, Agent, or Firm—Leydig, Voit, Osann, Mayer & Holt, Ltd.

[57] **ABSTRACT**

A combined microwave-thermal range having an oven cavity with a thermal heating element for baking and self-cleaning purposes, the bottom wall of the oven cavity having an inlet opening and the top wall having a vent opening. A microwave module mounted in space provided under the bottom wall of the cavity includes a microwave power supply housing enclosing a magnetron and blower. The module has an associated waveguide secured to the top of the housing and extending cantilever-fashion close to the bottom wall of the cavity, with the outlet of the waveguide in alinement with the central opening couples microwave energy from the waveguide to the cavity. Blower air passes from the blower inlet through the magnetron and waveguide and into the cavity for ventilating the same. The blower inlet is located at a level below the bottom wall of the cavity so that, when the blower and magnetron are turned off and the thermal element is turned on, air passing through the blower, power supply housing and waveguide flows upwardly by natural convection into the opening in the bottom wall of the cavity with final escape through the vent at the top of the cavity.

7 Claims, 16 Drawing Figures



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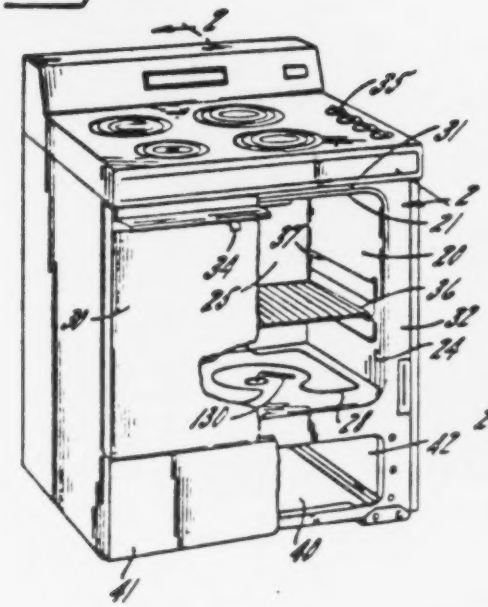

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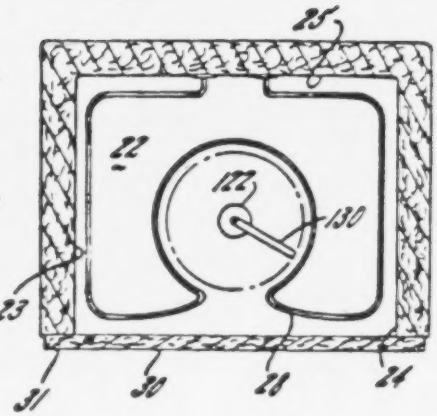

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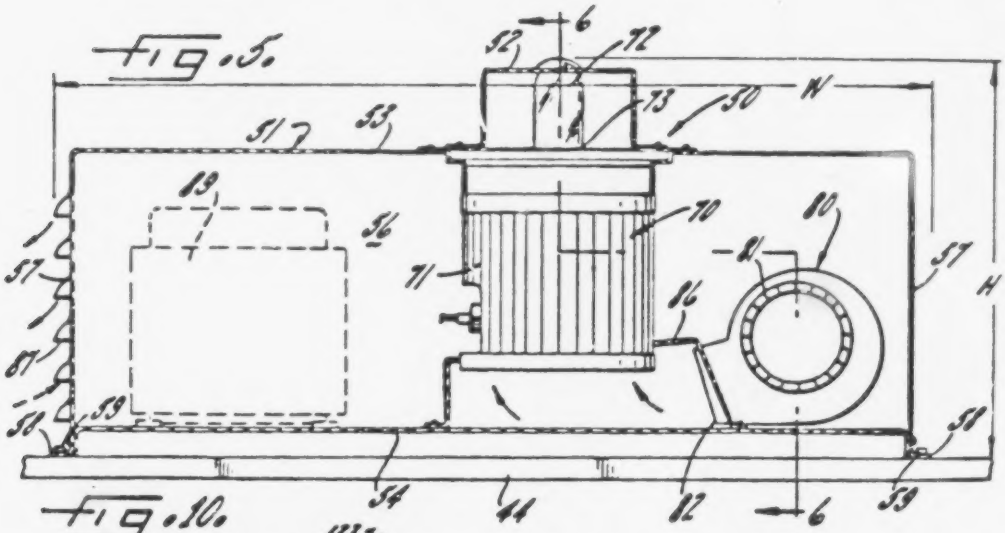

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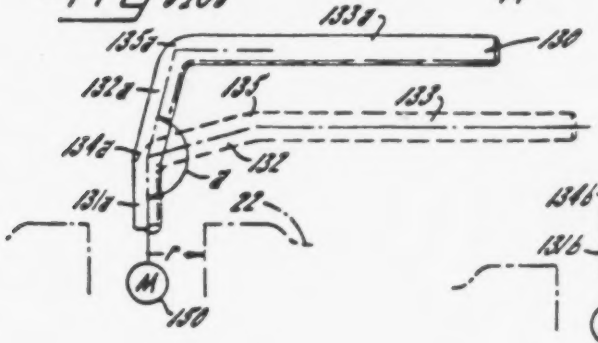

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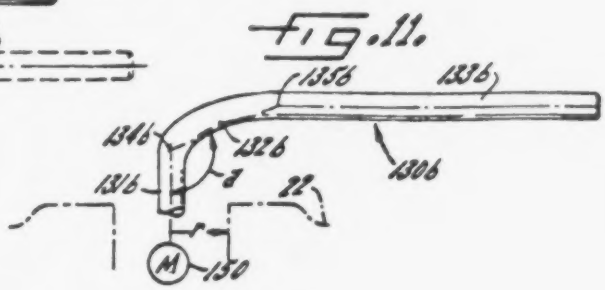

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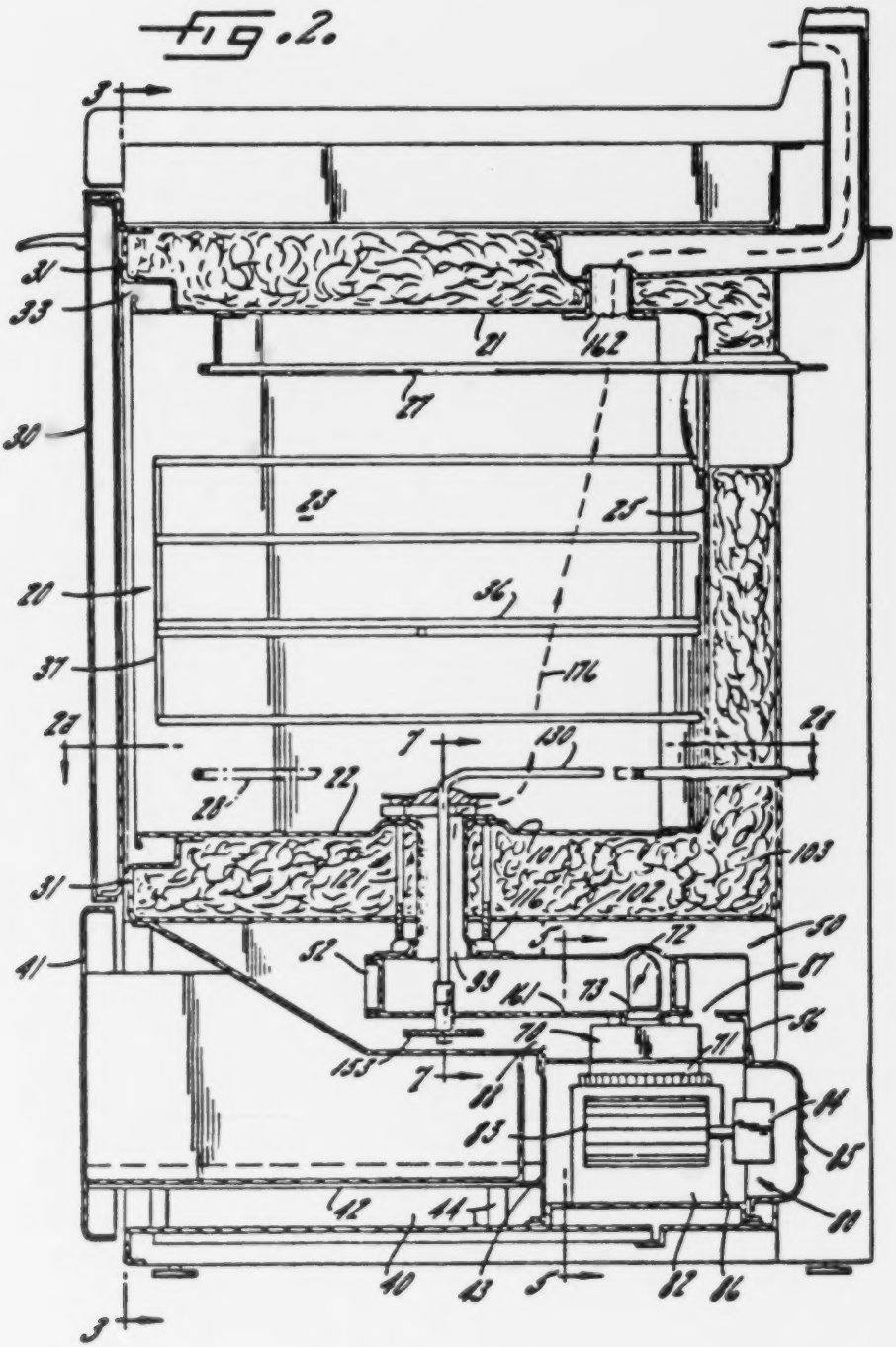
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fig. 3.

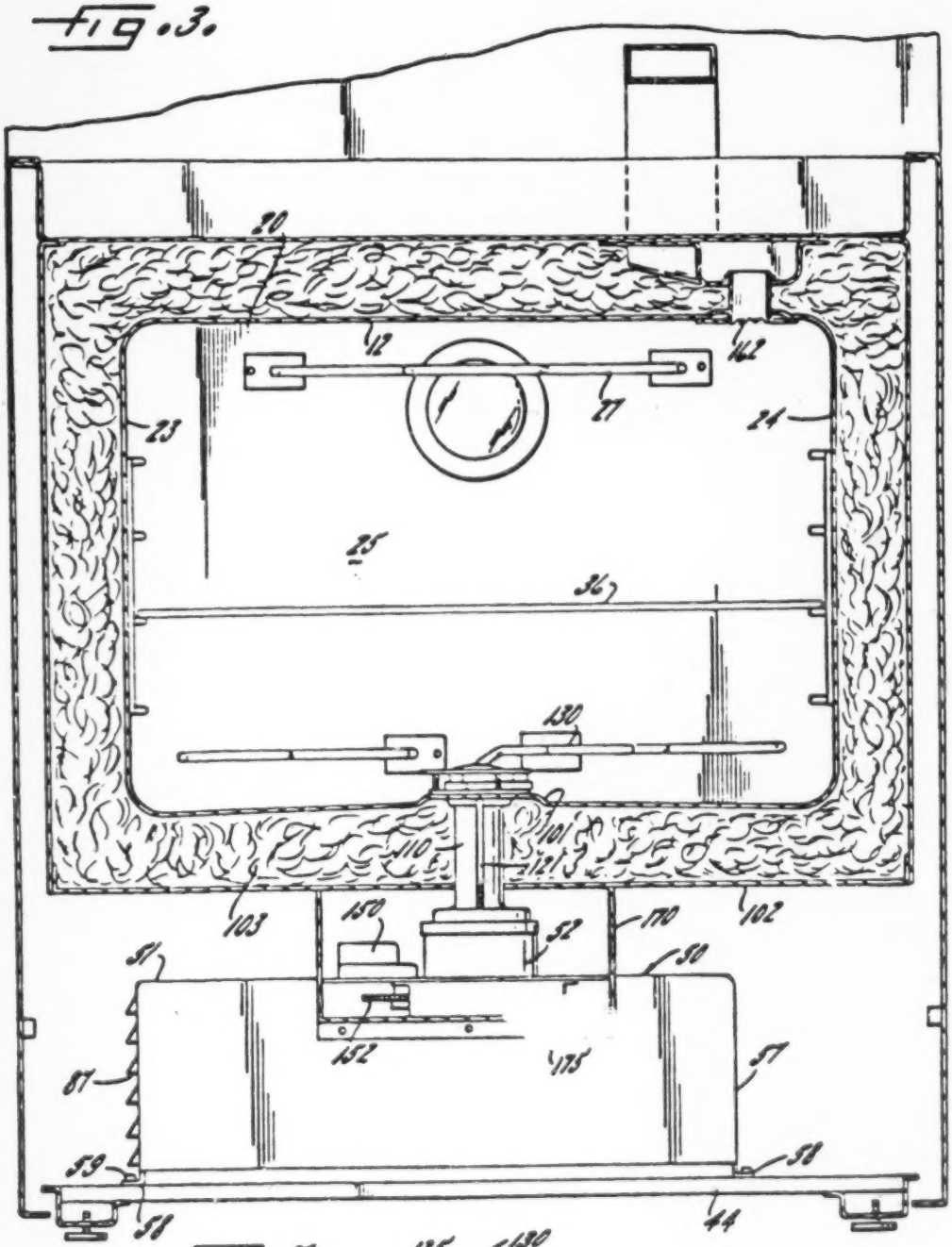
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fig. 7a.

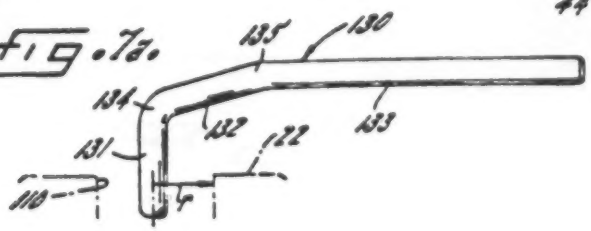
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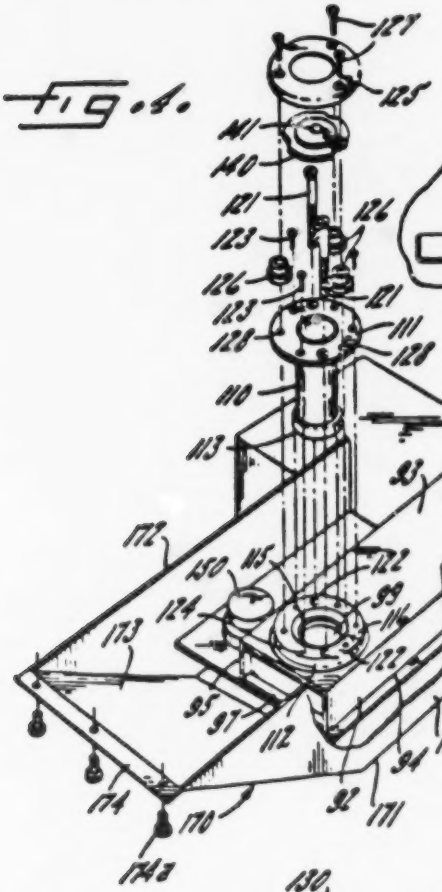
Fig. 4.



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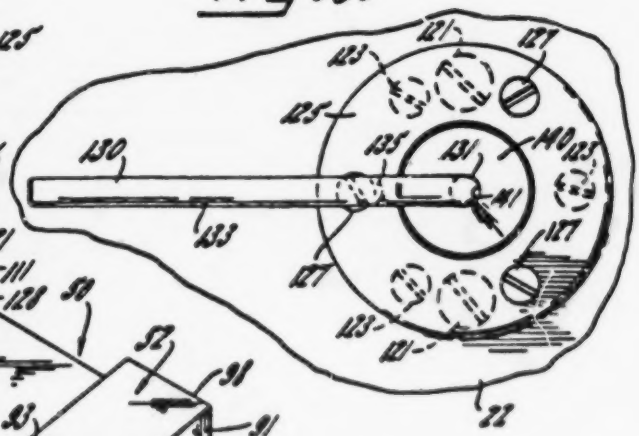

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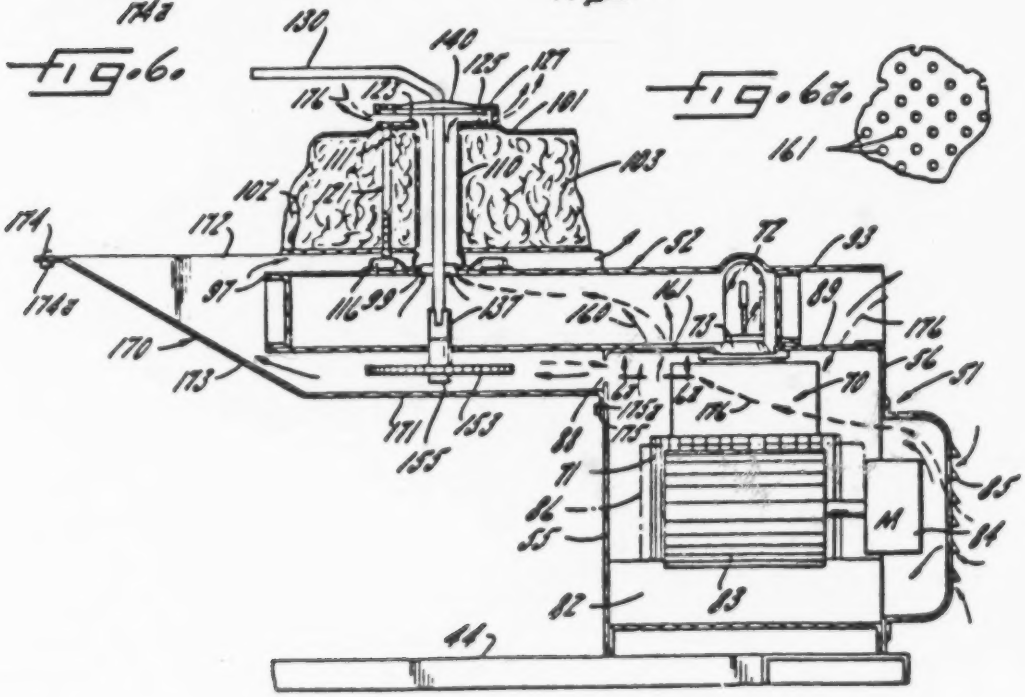

Fig. 6a.

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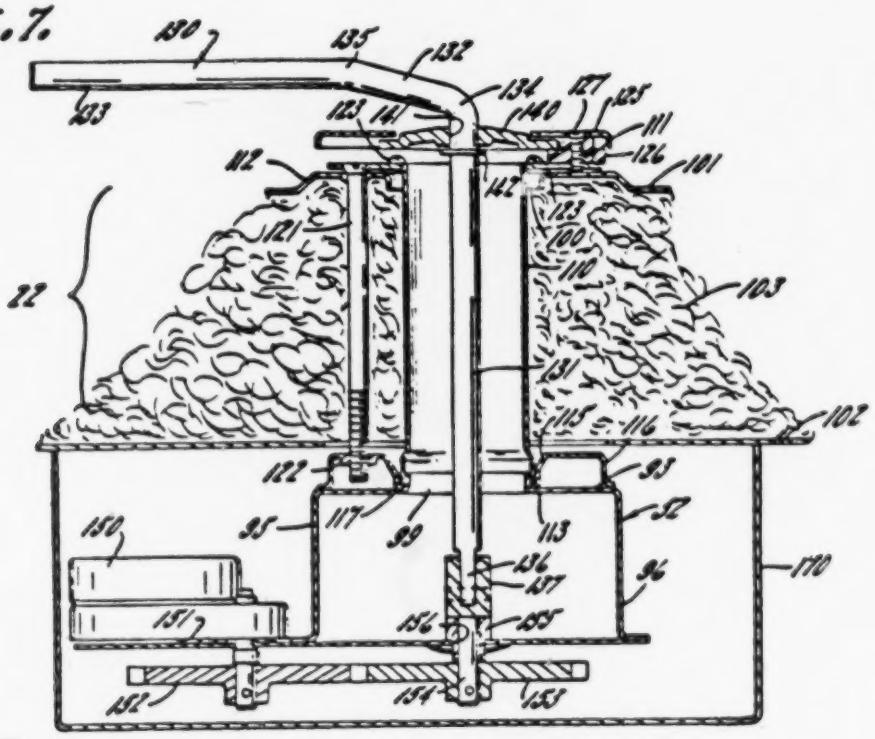
Fig. 7.



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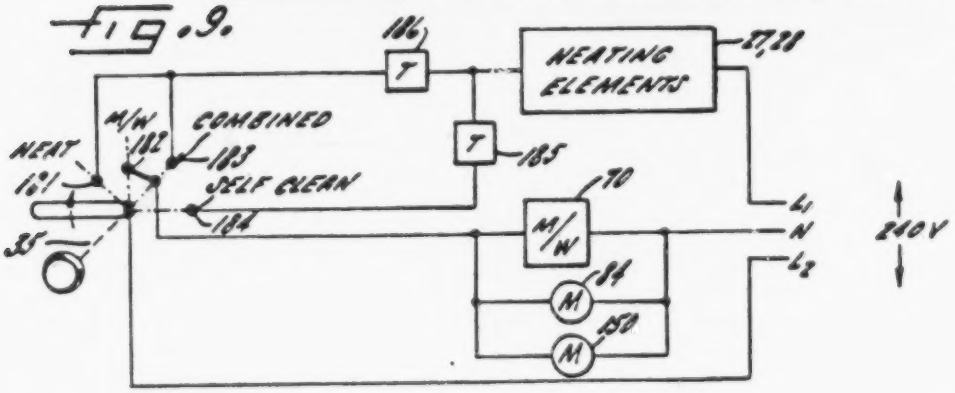

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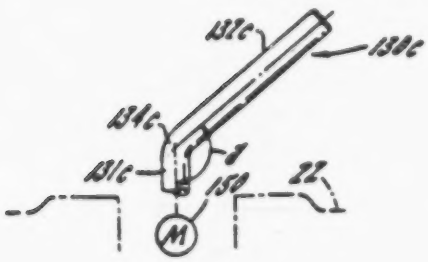

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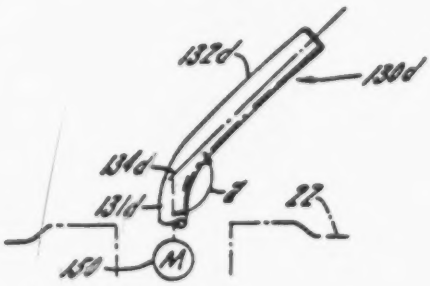

AIR FLOW SYSTEM FOR COMMON CAVITY MICROWAVE OVEN

BACKGROUND OF THE INVENTION

For a number of years oven cavities have been employed for both thermal cooking and microwave cooking, as evidenced by Boehm U.S. Pat. No. 3,440,386 and French Pat No. 1,249,130. However, such structures present practical problems where operated in three modes namely microwave, thermal and self-clean. Thus when the temperature in the cavity is raised to a level, on the order of 900° F., capable of producing thermal decomposition of the soil on the cavity surfaces, a slightly positive pressure is created causing back-up of the heated air and volatile decomposition products into the waveguide where condensation takes place, resulting in an accumulation, or build up, of sticky residue which not only serves to contaminate the air subsequently flowing through the waveguide during normal cookery, but which can affect the transmission characteristics of the waveguide. Such accumulation is extremely difficult to remove, requiring substantially complete disassembly of the power supply housing and waveguide.

It is, accordingly, an object of the present invention to provide a common cavity oven capable of microwave and thermal cookery and which is in addition capable of positively and reliably expelling the decomposition products when operated at high temperature in a self-clean mode. It is a related object of the present invention to provide a common cavity oven which is sealed against escape of microwave energy when operated in the microwave mode but which nevertheless has good ventilation characteristics when operated in the thermal and self-clean modes, insuring a well defined and unidirectional ventilation path regardless of the operating temperature and which prevents backflow of the air and volatile products of decompostition into the inlet opening regardless of the temperature achieved within the cavity.

It is a more specific object to provide a ventilation system which is capable of resisting auto ignition pressures of the products of decomposition and in which unidirectional flow of ventilating air is assured even in the presence of severe soil.

It is yet another object to provide a ventilation scheme for a single cavity oven which is capable of operating in the self-clean mode but which is simple and economical avoiding use of screens, restrictions and the like which have been resorted to in prior structures in order to insure against backflow of contaminated air.

It is a general object to provide a ventilating system for a common cavity oven usable in all three modes of operation and which is safe in all three of the modes and which runs no risk of violent explosion of the products of combustion in the self-clean mode.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a perspective view of a free standing electric range of conventional design but incorporating a source of microwave energy and having provision for use of thermal and microwave energy simultaneously in a common oven cavity.

FIG. 2 is a vertical cross section looking along the line 2—2 in FIG. 1.

FIG. 2a shows the relation between the antenna and heating element looking along the line 2a—2a in FIG. 2.

FIG. 3 is a front view of the oven of FIG. 1 with the door and drawer removed and looking along the line 3—3 in FIG. 2.

FIG. 4 is a perspective view of a microwave module constructed in accordance with the present invention.

FIG. 5 is a vertical section taken through the microwave module, with the front wall removed, and looking along line 5—5 in FIG. 2.

FIG. 6 is a transverse section taken through the module looking along the line 6—6 in FIG. 5.

FIG. 6a is a fragment taken along line 6a—6a in FIG. 6.

FIG. 7 is a cross sectional view through the hollow conductor and antenna assembly looking along the line 7—7 in FIG. 2.

FIG. 7a is a profile view of the antenna in FIG. 7.

FIG. 8 is a top view of the antenna looking along line 8—8 in FIG. 7.

FIG. 9 is a schematic diagram of a control circuit permitting three modes of cookery plus self-cleaning.

FIG. 10 is a profile view of an antenna of modified contour.

FIG. 11 is a profile view of a further modification of antenna.

FIGS. 12 and 13 show profiles of antennas of dogleg shape in straight and curved versions.

While the invention has been described in connection with certain preferred embodiments, it will be understood that we do not intend to be limited to the particular embodiments shown and that we intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

DETAILED DISCLOSURE

Turning to FIGS. 1 and 3 there is shown a typical free standing electric range to which the present invention has been applied. The range has an oven cavity 20 including a top wall 21, a bottom wall 22, side walls 23, 24 and a back wall 25. All of the walls are of "sandwich" construction formed of spaced sheets of metal with insulation, preferably in the form of glass wool, in between. Spaced downwardly a short distance from the top wall 21 is a heating element 27. A second heating element 28 is spaced a short distance above the bottom wall. The oven cavity is enclosed by a hinged door 30 having a gasket 31 which provides continuous and unbroken engagement with a land surface 32 on the range body. The gasket is of the type intended for shielding against escape of thermal and microwave energy, and its effect may be supplemented by use of a continuous choke 33 for which additional reference may be made to prior patents and technical publications. It will be assumed, as the discussion proceeds, that the range has wellknown provision for high temperature self-cleaning. Consequently, a latch is used having a latching control 34, with the mode of operation being selectable by a mode switch 35 at the top of the range. Within the oven cavity is a grid-type shelf 36 formed of metallic conductors in spaced parallel relation and extending horizontally over the entire area of the cavity. The shelf preferably has no central crossbar extending perpendicularly to the conductors. Metallic

supports are used at the respective ends of the shelf, however, we employ no means to assure positive grounding of the supports. We have found with our feed system that arcing does not occur in the oven in spite of intermittent metal to metal contact, therefore, we neither intentionally ground rack and rack supports in the conventional manner nor intentionally insulate them.

Below the oven cavity 20, and of generally conforming shape, is a storage space having a closure 40 forming a portion of a drawer 41 mounted upon slides 42 and dimensioned to define a space 43 to the rear of the drawer. Extending horizontally at the bottom of the rear space 43 are supporting members 44.

In carrying out the present invention there is provided, at the rear of the storage space, a microwave module including a microwave power supply housing of generally rectangular shape having a magnetron, blower and associated circuitry, with a waveguide of rectangular section secured at its rear end to the top of the housing and having its front end extending forwardly cantilever-fashion under the bottom wall of the cavity. Referring to FIGS. 2–5 the microwave module, indicated generally at 50, is formed of a power supply housing 51 and a forwardly extending waveguide 52, the total width W and height H of the module being such that the module may be both inserted and withdrawn through the drawer opening.

The power supply housing 51 is of rectangular or box shape having top and bottom walls 53, 54, front and back walls 55, 56 and end walls 57. Each of the latter terminates in a mounting flange 58 which is secureable by suitable screw fasteners 59 in a seated position upon the supporting members 44.

Vertically mounted in the power supply housing is a conventional magnetron 70 (FIGS. 5 and 6) having cooling fin structure 71 and a glass or ceramic enclosure 72 for the antenna, which extends upwardly through a waveguide inlet 73 formed in the underside of the waveguide 52. Reference is made to prior patents for typical magnetron power and control circuits.

For the purpose of cooling the magnetron and ventilating the cavity during microwave usage, a blower 80 is provided having an inlet 81 and an outlet 82. The blower has a rotor 83 driven by a motor 84 and which sucks in air through an opening 85 in the rear of the housing. Air from the blower is conducted to the underside of the magnetron through a duct or connection 86 passing upwardly through the fins. The slightly warmed air, discharged at the top of the magnetron fin structure, flows into the housing to create a slight internal pressure. The bulk of the air is vented directly from the housing through several large openings including a set of louvers 87 in the end wall of the housing, an auxiliary air opening 88 in the front wall, to which further reference will be made, and a rear discharge opening 89. The remaining space within the housing, in addition to that occupied by the blower and magnetron, will be understood to be taken up by the transformer and other necessary magnetron circuit components.

Turning attention next to the waveguide 52, it is preferably of rectangular cross section, secured at its rear end 91 to the top of the housing 51 and cantilevered forwardly so that its front end 92 underlies the central portion of the bottom wall 22 of the range cavity. The waveguide has top and bottom surfaces 93, 94, side surfaces 95, 96 and end surfaces 97, 98, thereby ...ing a tube leading from inlet 73 to an outlet 99. The outlet 99 is in axial register with an opening 100 (see especially FIG. 7) formed in the bottom wall 22 of the oven cavity. The opening 100 penetrates first and second bottom plates indicated at 101, 102, the space 103, in between, being filled with glass wool or similar thermal insulation.

For the purpose of coupling the outlet 99 of the waveguide with the cavity opening 100, a connector is provided in the form of a hollow-open-ended conductor or tube 110 which is telescoped into the opening 100 and which has a circular flange 111 at its upper end which seats on the bottom wall 22 of the cavity. More specifically, the flange seats upon an upraised annular land 112 which is formed in the plate 101 and which surrounds the opening 100, the land serving as a dam to prevent leakage of oven spills into the hollow conductor and thence into the waveguide.

For the purpose of sealing the hollow conductor 110 to the top of the waveguide in register with the outlet 99, a socket 115 is provided on the waveguide, the socket receiving the circular lower end 113 of the conductor. Such socket is defined by an annular mount 116 made of pressed metal and which is spot welded or otherwise securely fastened to the top wall 93 of the waveguide. At the root of the socket is a resilient conductive gasket 117 which may, for example, be formed of metal gauze.

For clamping the hollow conductor against the gasue in the socket 115, a pair of clamping screws 121 are provided which extend through registering openings in the flange 111, with the threaded tips of the screws being received in tapped openings 122 in the mounting member 116.

The screws 121 are not, however, relied upon to keep the flange 111 tightly seated against the land. Preferably three additional screws 123 project through registering openings in the flange to engage tapped holes 124 in the land.

Spaced above the flange 111 is a mounting ring 125 which is supported upon short pedestals 126. The mounting ring 125 is secured by screws 127 which telescope through the flange and into registering tapped holes in the land.

Thus in assembling the device the flange is seated on the land and the screws 121 are tightened in the threaded holes 122 to seat the conductor 110, at its lower end, firmly against the socket 115 in the waveguide. The screws 123 are then tightened in place to doubly insure that the flange 111 is intimately seated against the land. Finally, the screws 127 are inserted into the mounting ring, and tightened.

Because of the cantilever extension of the waveguide 52 upon the housing 51, the waveguide occupies a nominal position from which it may be resiliently deflected without strain or damage to the module; for example, when the screws 121 are turned to draw the hollow conductor down into contact with the gasket 117, the end of the waveguide is simultaneously drawn upwardly through a small angle, resiliently twisting the module, until opposition to turning of the screws indicates that the hollow conductor 110 is fully bottomed. Seating of the hollow conductor to provide a tight joint at both ends is assured, notwithstanding dimensional variations, under production-line conditions, between the bottom 22 of the cavity and the plane of the supports 44 in the storage space.

In accordance with the present invention (FIG. 7) an antenna is mounted for rotation coaxially in the hollow conductor 110, the antenna being coupled at its lower end to a motor and drive train mounted upon the waveguide. As will be discussed in greater detail, the antenna, indicated at 130 has a straight shank portion 131 which is coaxially arranged in the conductor 110, a "transitional" portion 132 which is upwardly angled and a radial arm portion 133. In the preferred embodiment the antenna is formed by first and second abrupt bends 134, 135. The lower end of the antenna, indicated at 136 is keyed for reception in a rotatable mount 137 journaled in the bottom wall of the waveguide. To serve as a bearing for the upper end of the antenna, and to shield the upper end of the hollow conductor from food spills or other foreign matter, is a ceramic disc 140 supported within the amounting ring 125 on the posts 126 and having a central opening 141. The antenna is held captive in the central opening by a snap ring 142 which is in interfering relation with the underside of the disc.

It is one of the features of the present construction that the entire antenna and hollow conductor assembly may be conveniently removed, when service becomes necessary, from the inside of the oven cavity. By unscrewing the screws 127, the mounting ring 125, disc 140, and the antenna itself may be drawn clear of the conductor. Next, unscrewing the screws 121 frees the lower end of the conductor 110 from its seat on the waveguide, and unscrewing the screws 123 permits separation of the conductor flange 111 from the land 112 on the bottom wall of the oven so that the conductor may be lifted clear. The conductor assembly may be reinstalled by simply reversing the procedure.

For the purpose of rotating the mount 137, a small, clock-type driving motor 150 is provided having internal gear reduction. The motor is mounted on the top side of a motor mounting flange 151 which extends from the side of the waveguide. Pinned to the motor shaft is a first gear 152 located on the underside of the waveguide and which meshes with a second gear 153 which is pinned to a shaft 154 forming a part of the mount 137. The shaft is journaled in a bearing 155 of plastic or the like which occupies an opening 156 in the bottom of the waveguide, the opening being sufficiently small so that negligible leakage occurs. The motor gear reduction, and the ratio of gears 152, 153, in such that the antenna rotates at a low speed which may, for example, be on the order of 5 to 10 revolutions per minute, in any event providing a period of rotation which is less than the shortest cooking cycle.

In accordance with one of the features of the invention air passages are provided between the power supply housing so that a portion of air from the blower 80, and which cools the magnetron, flows through the waveguide and hollow conductor for ventilating the cavity when the blower is on, for final venting from the top of the cavity, with the same air path being utilized to set up flow of convected air during thermal cooking, and during self-cleaning, when the blower is off. Thus a pattern of small air passages 161 is provided in the wall of the waveguide, and between the housing and waveguide, as shown in FIG. 6, and a vent 162 is provided at the top of the cavity as shown in FIGS. 2 and 3. The path of the convected air is indicated by the dotted arrows 176 to distinguish over the forced air path which is indicated by the arrows which are solidly drawn. The passages 161, 162 are preferably sufficiently small, or screened, so that there is no leakage of microwave radiation either from the module or the cavity. Moreover, the passages 161 are so related, in area, to the main air discharge opening 87 and auxiliary air openings 88, 89 that the forced air flow through the cavity is limited to something on the order of three to eight cubic feet per minute. During thermal cooking, when the blower is turned off, the fact that the openings 86, 87 and 88 in the housing 51 are in a "low" position, below the bottom of the cavity, the fact that the waveguide 52 feeds air inwardly at the bottom of the cavity, and the fact that the vent 162 is in a "high" position at the top of the cavity, provides sufficient convection, on the order of 0.5 to 2.0 cfm., depending upon temperature, for both baking and self-cleaning operations. The path of the convected air is, however, sufficiently constricted so that the air flow for self-cleaning is below that which runs risk of explosion. It may be noted that while air flows outwardly of the air discharge openings 87, 88 during the blower mode, air flows inwardly, through the same openings, in the convection mode. The vent 162 may optionally be formed in the back or side walls at the very top of the cavity.

As a further feature combining both ventilation benefits and physical protection, a through shaped guard or shield is provided at the front of the power supply housing for surrounding and underlying the waveguide for protection of the waveguide and motor driving train against impact from articles stored in the drawer as well as for conducting forced air from the opening 88 in the housing along the waveguide for cooling both waveguide and motor. The guard 170 has a bottom wall 171, side walls 172, and a sloping front wall 173. The latter terminates in a flange 174 which is secured by screws 174a to the underside of the bottom plate 102 of the cavity. A second flange 175 at the rear of the guard is secured by screws 175a to the front wall 85 of the housing. It will be seen that such enclosure not only provides physical protection but defines a path for the pressurized air, the air flowing in the direction of arrow 176 from the opening 88 (see FIG. 6), making a U turn at the front end of the waveguide, and flowing backwardly along the sides of the waveguide for exit at the top of the housing. In this way air is usefully employed which would otherwise simply be discharged into the room. Because of the relatively small clearance requirements under the waveguide, the guard 170 does not appreciably subtract from the useful storage volume.

A rudimentary control circuit providing for use of either type of energy, or both, is illustrated in FIG. 9. The mode selector switch 35 is used having a first contact 181 for thermal heat, a second contact 182 which energizes the magnetron, and a third, or dual, contact 183 which turns on both of the energy sources. As indicated in this figure, the blower motor 84 and antenna motor 150 are turned on whenever the magnetron is turned on but are off at all other times. A fourth or "self-clean" position 184 is also provided, with the self-clean temperature being regulated by a thermostat 185.

In the case of normal cooking, the temperature is regulated by a conventional thermostat 186 in series with the heating elements. It will be understood that a practical control circuit is much more elaborate than that illustrated in FIG. 9, particularly as regards the safety features which are effective in the self-clean mode.

While the operation and easy replacement of the microwave system will be apparent from the foregoing, the following summary is offered. With the mode switch 35 in the "combined" mode, the heating elements establish a temperature set by the thermostat 186, and the magnetron, blower motor 84 and antenna motor 150 are all energized, with the wave from the antenna being swept throughout the cavity for equalized distribution of microwave energy, as will be described. A portion of the blower air feeding through air passages 161, and thence through the waveguide and hollow conductor, is discharged under the antenna supporting disc 140 into the cavity for eventual escape through the vent 162 at the top of the cavity. The bulk of the pressurized cooling air is discharged directly from the housing through the openings 87, 89 and, via opening 88, into the guard 170 which surrounds the waveguide and antenna motor so that all of the microwave components are kept at a safely low temperature regardless of the thermal temperature achieved in the cavity.

Because of the fact that all of the inlet openings for the convected air are well below the level of the bottom wall of the cavity, the convection pressure differential is sufficiently great to insure upward flow through the system even in the face of pressure developed by "auto ignition" as the soil is decomposed, so that there is no back-up of the decomposition products into the waveguide. Air follows the dotted air flow paths for convected passage of the air through the housing, waveguide and cavity with eventual venting at the top vent 162, without reliance upon the usual gap in the door gasket free of possibility of back-up or explosion.

In the event that servicing of the module is required, the hollow conductor assembly which communicates with the front end of the waveguide is loosened and retracted upwardly as previously described. Unscrewing of the screws 121 frees the front end of the waveguide from the oven structure. Subsequent removal of screws 174*a*, 175*a* which secure the trough 170 and screws 59 which hold the housing in seated position, permits the module to be pulled forwardly through the drawer opening. Electrical disconnection of the power supply module may be facilitated by a simple multiprong plug and socket. In a typical service call a new module is slipped in place by simply reversing the procedure.

ROTARY ANTENNA

The preferred form of antenna 130 disclosed in FIG. 7*a*, rotated at a relatively slow speed on the order of a few revolutions per minute, has been found to be highly effective in bringing about an equalized distribution of microwave energy throughout the cavity with relative freedom from the hot spots which usually characterize microwave cookery. The antenna is distinguished by a straight shank portion 131 and a radially extending arm portion 133 which is arranged approximately perpendicularly with respect to the shank, with an angled transitional portion 132 in between, the angled portion bearing an obtuse angle with respect to both the shank and the arm and having a length of at least the radius *r* of the hollow conductor for radiation of a guided wave in the cavity which sets up a plurality of radiation patterns.

In understanding the operation of the antenna it will, first of all, be appreciated that microwave energy is directly propagated from the waveguide into the cavity independently of antenna action, the resulting wave been referred to as the "inertial" wave. In addition, microwave energy which is coupled to the lower end of the antenna is guided along the antenna for radiation therefrom in the form of a "guided" wave. Where an L shaped or T shaped antenna is employed having an abrupt 90° bend, it is found that the bend constitutes a major discontinuity which actually prevents microwave energy from being converted to a guided wave. However, where the antenna, at point of exit, is bent on a more gradual basis, that is, is bent over a transitional region of at least the radius of the hollow conductor through which it projects into the cavity, the proportion of energy in the guided wave, as compared to the inertial wave, is increased and, in addition, the guided wave controls the pattern of radiation within the cavity. The increased number of radiation patterns, with continuous sweeping, inherently produces fewer hot spots than either the simpler, stationary mode patterns achieved using, for example, an antenna of the conventional monopole type, or a conventional antenna in combination with auxiliary stirring means.

In the preferred form of the invention, illustrated in FIG. 7*a*, the antenna has two concentrated bends 134, 135 to define its three portions. The radial arm portion 133 has a length which is preferably greater than the transitional portion to improve radiation patterns and/or facilitate impedance matching while maintaining a low profile. In practical cases the total radial length of the antenna may be on the order of 2.0 to 5.0 inches.

It is one of the features of the antenna that the bends 134, 135 are so related to one another that the antenna lies in the plane of the lower heating element 28. Although the antenna illustrated in FIG. 7*a* can be employed with conventionally formed U shaped heating elements whose surfaces are remote from the antenna, for those cases where the antenna tip overlies a heater surface, the preferred heater shape, as shown in FIG. 2*a*, is circumferentially distributed about the antenna path at a substantially constant radius so that the effect of the heating element 28 upon the radiated energy remains substantially constant throughout the rotational cycle.

Moreover, by spacing the radial portion 133 of the antenna, and the heating element 28, at the same relatively close spacing to the adjacent (bottom) wall 22, there is minimum encroachment upon the space within the cavity; in other words, a high degree of compactness is achieved. In a practical case, the spacing of the heating element and antenna from the adjacent wall is on the order of one and one-half inch. By keeping the antenna within the confines of the bottom heating element, and with the latter distributed as shown in FIG. 2*a*, the antenna itself does not take up any additional space within the cavity, making the utilization of space much more efficient than where a stirring device or conventional type of rotating antenna is employed.

It will be understood, however, that the invention is not limited to the exact profile illustrated in FIG. 7*a* and, if desired, the slightly higher profile, illustrated in FIG. 10, may be used. In this embodiment, in which corresponding reference numerals are used with addition of subscript *a* to indicate corresponding parts of the device, the included angle *a* at the first bend 134*a* is increased and the included angle at the second bend 135*a* is decreased. Preferably the angle *a* should be kept within the range of 105° to 165°, while the in-

cluded angle at the second bend should be approximately (270° - a) to provide a low profile.

While it is preferred to form the antenna with concentrated bends, the antenna may be gradually bent or smoothly "faired" over the length of the transitional portion as indicated in FIG. 11, which corresponds to FIG. 7a, the same numerals being employed with addition of subscript b. Thus it will be noted that the transitional portional 132b has a length at least the radius r of the hollow conductor between the point 134b denoting the end of the shank and the point 135b denoting the beginning of the radial arm 133b.

The invention is not, however, limited to the embodiments illustrated in FIGS. 10 and 11 but includes the dogleg configuration set forth in FIGS. 12 and 13 where corresponding elements are denoted by the same reference numerals with addition of subscripts c and d, respectively. Thus referring to FIG. 12 the antenna has a straight shank portion 131c which is coaxially arranged in the hollow conductor, with a bend 134c which is substantially less than 90° to produce an included angle a which preferably lies within the range of 95° to 165°, the angled portion 132c being preferably at least equal in length to the radius of the hollow conductor. The structure of FIG. 13 corresponds to that of FIG. 12 except that the concentrated bend 134c has been replaced by a gradual bend to define an angled portion 132d having the same effective length.

In each of the illustrated embodiments of FIGS. 10 – 13 the use of an obtuse angle a to define a transitional portion 132 of dogleg configuration results in efficient guidance of energy from the shank to the radiating portions of the antenna with minimum electrical discontinuity thereby to control the ratio between the energy in the guided wave and that in the directly emitted, or inertial wave, with the guided wave being effectively superimposed upon the inertial wave and swept continuously throughout the cavity for improved energy distribution in the cavity with relative freedom from hot and cold spots. Thus the distribution is to be distinguished from that using a conventional monopole which tends to concentrate energy in a radial ring concentric with the monopole and the various types of "mushroom" antenna configurations which tend to distribute energy about the periphery while leaving a relatively large "hollow" energy region at the center of the cavity. It is found that using a rotated antenna of the above-described design the usual metal grid type of shelf employed in conventional electric ranges is effectively penetrated. It is one of the observed benefits of the invention, that arcing between metallic conductors placed within the oven cavity does not occur. Special precautions such as proper microwave grounding or insulated standoffs are not needed for metal grid shelves, shelve supports, or heating elements. This, while not fully understood, is attributed to the uniform energy distribution within the cavity.

It is one of the observed benefits of the present invention that a larger percentage of energy reaches the foodstuff along a direct radiation path than in conventional microwave ovens. Thus, using an electrically transparent vessel to contain the foodstuff, with the vessel supported in a generally central position, microwave energy received from the waveguide and from the rotating antenna creates even internal heat within the foodstuff, free of hot or cold spots as described. Such energy transfer is more uniform than that which occurs by reason of uncontrolled multiple reflection against the walls of the cavity, thereby reducing the time it takes to completely cook the foodstuff.

While it is preferred to use electrically transparent cooking vessels, another of the observed benefits of the described antenna is the fact that the cooking pattern does not seriously degrade when cooking with metallic utensils, nor do metallic cooking utensils cause adverse operating conditions harmful to magnetron operating life. Evidently the secondary reflections which occur also produce a more uniform energy distribution than that which occurs from conventional monopole or stirrer type microwave energy distribution systems.

Conventional sources of waveguide energy are highly sensitive to the dimensions and proportions of the cavity in which the energy is utilized. Thus, starting with a cavity of a certain dimension it has been necessary in the past to "tailor" the antenna and waveguide to the cavity and to make other adjustments including the position of point of feed in order to create a desired modal pattern. It is found, by contrast, that the present design of module and its associated antenna is largely independent of the size and dimensional proportions of the cavity so that the module and antenna assembly may be utilized by the manufacturers of different types, sizes and designs of oven cavities, free standing, built-in, and portable as well, on an O.E.M. basis, and with the only modification of the basic range structure being the provision of seating for the housing at a proper level and the use of a hollow conductor and clamping screws of appropriate length accommodated to the thickness of the lower insulated wall of the cavity. As a result almost any design of thermal oven may be modified to include microwave energy at a relatively small increment in cost, greatly expanding the market for microwave devices and indeed expanding the market for ranges in general.

While the above discussion has emphasized conversion of an electric range to microwave usage, it will be understood that the present microwave module is also applicable to conversion of gas ranges, although the latter will, of course, require a greater degree of modification. Consequently, the term "thermal element" will be understood as not being, necessarily, limited to an electric heating element. The term "storage space" has been used for convenience to apply to any available space adjacent the regular oven cavity.

Although it is preferred to seat the microwave power supply housing in a remote position in the storage space, it is conceivable that in a range design providing a wide oven having a limited front-to-back dimension, it may be more convenient to mount the microwave housing along the side of the storage space with some sacrifice in the width, but not length, of the drawer. Consequently, the term "back" used in connection with storage space shall be considered to be a relative term including both of the positions. The term "hollow conductor" which has been applied to the hollow tube 110 is also a general term applying to means defining any opening or passage between a waveguide and an oven cavity and the length of which depends upon the thickness of any insulating layer which may be provided. The term "waveguide" shall be considered to cover any conductor of wave energy from the magnetron for discharging microwave energy into, or which energizes an antenna in a shielded oven cavity. Thus the term waveguide as used herein includes a coaxial transmission line. The term "magnetron" refers to any source of high intensity microwave energy.

It is found that the structure described above produces a field which is so uniform and a result which is so predictable, that "formula cookery", based upon conventional cookbook instructions, is possible for the first time. Specifically, in the case of pastry and similar baked goods, the foodstuff, in normal quantity, is subjected to microwaves for a period of five minutes, after which baking is completed using thermal energy at the temperature, and in just one-half of the time, given in the conventional cookbook. In the case of other foods, both types of energy are applied from the beginning of the cycle and the total cooking time is reduced to one-quarter of that given in the cookbook.

What is claimed is:

1. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element at a normal temperature level for food preparation and at a high level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply including a blower and a magnetron having cooling fins, the blower having a blower inlet for drawing in cooling air and an outlet for supplying such air under slight pressure to the cooling fins, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, means defining air passages of limited cross section for conducting air from the magnetron into the waveguide so that a portion of the pressurized air passes through the waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a lever below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected from the blower inlet through the air passages into the waveguide and into the cavity for exiting through the cavity air vent notwithstanding the auto ignition pressure which exists in the cavity under high temperature self-cleaning conditions, the convention path of the air being sufficiently constricted so that air is convected in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of decomposition.

2. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element within a normal temperature range for food preparation and at a high temperature level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for supplying under slight pressure to the magnetron with discharge of at least a portion of the air into the housing to create slight pressure therein, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, means defining a pattern of small air passages from the housing to the waveguide so at least a portion of the pressurized air from the housing passes through the air passage and waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, all portions of the waveguide and housing including the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected from the blower inlet through the small air passages and waveguide into the cavity for exiting through the cavity air vent, the convection path of the air being sufficiently constricted so that air is convected in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of thermal decomposition.

3. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air from outside the housing for supplying under slight pressure to the magnetron, the cooling air being discharged from the magnetron into the housing for creating internal pressure therein, a waveguide coupled to the magnetron and extending along the housing and under the bottom wall of the cavity, the waveguide having an outlet alined with the opening in the bottom wall of the cavity, a hollow open-ended conductor extending through the opening for coupling the outlet of the waveguide to the cavity, means for securing the upper end of the hollow conductor to the bottom wall of the cavity and the lower end of the conductor to the waveguide for conduction of microwave energy into the cavity, the wall of the waveguide having a pattern of small openings communicating with the housing so that a portion of the pressurized air from the blower and magnetron passes through the waveguide and hollow conductor into the cavity for ventilating the cavity when the magnetron and blower are turned on, the housing having a relatively large vent opening through which the pressurized air therefrom passes outwardly to reduce the internal pressure in the housing thereby to reduce the flow of air through the pattern of small openings and into the cavity to a predetermined low level, the blower inlet and large vent opening being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on flow of air through the large vent opening is reversed in direction flowing inwardly through such vent opening into the housing and through the small openings via the waveguide into the cavity with final exiting through the cavity air vent.

4. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door en-

closing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for supplying under slight pressure to the magnetron, a waveguide coupled to the magnetron and extending under the bottom wall of the cavity, the waveguide having an outlet alined with the opening in the bottom wall of the cavity, a hollow open-ended conductor extending through the opening for coupling the outlet of the waveguide to the cavity, means for securing the upper end of the hollow conductor to the bottom wall of the cavity and the lower end of the conductor to the waveguide for conduction of microwave energy into the cavity, an antenna element centered in the hollow conductor and projecting into the cavity for guiding microwave energy to the latter, means for conducting at least a portion of the pressurized air from the blower and magnetron through the waveguide and hollow conductor into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is convected through the blower inlet, waveguide and hollow conductor into the cavity for exiting through the cavity air vent at the top thereof.

5. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space of conforming shape, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element within a normal temperature range for food preparation and at a high temperature level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for discharge under slight pressure to the magnetron, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, the waveguide being open to passage of cooling air from the magnetron so at least a portion of the pressurized air from the blower and magnetron passes through the waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected through the blower inlet, magnetron, and waveguide into the cavity for final exit through the cavity air vent at the top thereof, the air passage through the blower, magnetron and waveguide being sufficiently constricted so that the air is converted in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of thermal decomposition.

6. The combination as claimed in claim 5 in which the constriction in the air passage through the blower inlet, magnetron and waveguide is in the form of a pattern of small openings in the wall of the waveguide and in communication with the housing, the openings being of sufficiently small dimension so as to preclude the escape of microwave energy therethrough.

7. The combination as claimed in claim 6 in which the openings in the wall of the waveguide and the vent opening are sufficiently limited in total area as to limit the flow of air for microwave cookery to within the range of three to eight c.f.m. when the blower is on and to reduce the flow of convected air under baking and self-cleaning conditions to within the range of 0.5 to 2 c.f.m.

* * * * *

While the operation and easy replacement of the microwave system will be apparent from the foregoing, the following summary is offered. With the mode switch 35 in the "combined" mode, the heating elements establish a temperature set by the thermostat 186, and the magnetron, blower motor 84 and antenna motor 150 are all energized, with the wave from the antenna being swept throughout the cavity for equalized distribution of microwave energy, as will be described. A portion of the blower air feeding through air passages 161, and thence through the waveguide and hollow conductor, is discharged under the antenna supporting disc 140 into the cavity for eventual escape through the vent 162 at the top of the cavity. The bulk of the pressurized cooling air is discharged directly from the housing through the openings 87, 89 and, via opening 88, into the guard 170 which surrounds the waveguide and antenna motor so that all of the microwave components are kept at a safely low temperature regardless of the thermal temperature achieved in the cavity.

Because of the fact that all of the inlet openings for the convected air are well below the level of the bottom wall of the cavity, the convection pressure differential is sufficiently great to insure upward flow through the system even in the face of pressure developed by "auto ignition" as the soil is decomposed, so that there is no back-up of the decomposition products into the waveguide. Air follows the dotted air flow paths for convected passage of the air through the housing, waveguide and cavity with eventual venting at the top vent 162, without reliance upon the usual gap in the door gasket free of possibility of back-up or explosion.

In the event that servicing of the module is required, the hollow conductor assembly which communicates with the front end of the waveguide is loosened and retracted upwardly as previously described. Unscrewing of the screws 121 frees the front end of the waveguide from the oven structure. Subsequent removal of screws 174*a*, 175*a* which secure the trough 170 and screws 59 which hold the housing in seated position, permits the module to be pulled forwardly through the drawer opening. Electrical disconnection of the power supply module may be facilitated by a simple multiprong plug and socket. In a typical service call a new module is slipped in place by simply reversing the procedure.

ROTARY ANTENNA

The preferred form of antenna 130 disclosed in FIG. 7*a*, rotated at a relatively slow speed on the order of a few revolutions per minute, has been found to be highly effective in bringing about an equalized distribution of microwave energy throughout the cavity with relative freedom from the hot spots which usually characterize microwave cookery. The antenna is distinguished by a straight shank portion 131 and a radially extending arm portion 133 which is arranged approximately perpendicularly with respect to the shank, with an angled transitional portion 132 in between, the angled portion bearing an obtuse angle with respect to both the shank and the arm and having a length of at least the radius *r* of the hollow conductor for radiation of a guided wave in the cavity which sets up a plurality of radiation patterns.

In understanding the operation of the antenna it will, first of all, be appreciated that microwave energy is directly propagated from the waveguide into the cavity independently of antenna action, the resulting wave been referred to as the "inertial" wave. In addition, microwave energy which is coupled to the lower end of the antenna is guided along the antenna for radiation therefrom in the form of a "guided" wave. Where an L shaped or T shaped antenna is employed having an abrupt 90° bend, it is found that the bend constitutes a major discontinuity which actually prevents microwave energy from being converted to a guided wave. However, where the antenna, at point of exit, is bent on a more gradual basis, that is, is bent over a transitional region of at least the radius of the hollow conductor through which it projects into the cavity, the proportion of energy in the guided wave, as compared to the inertial wave, is increased and, in addition, the guided wave controls the pattern of radiation within the cavity. The increased number of radiation patterns, with continuous sweeping, inherently produces fewer hot spots than either the simpler, stationary mode patterns achieved using, for example, an antenna of the conventional monopole type, or a conventional antenna in combination with auxiliary stirring means.

In the preferred form of the invention, illustrated in FIG. 7*a*, the antenna has two concentrated bends 134, 135 to define its three portions. The radial arm portion 133 has a length which is preferably greater than the transitional portion to improve radiation patterns and/or facilitate impedance matching while maintaining a low profile. In practical cases the total radial length of the antenna may be on the order of 2.0 to 5.0 inches.

It is one of the features of the antenna that the bends 134, 135 are so related to one another that the antenna lies in the plane of the lower heating element 28. Although the antenna illustrated in FIG. 7*a* can be employed with conventionally formed U shaped heating elements whose surfaces are remote from the antenna, for those cases where the antenna tip overlies a heater surface, the preferred heater shape, as shown in FIG. 2*a*, is circumferentially distributed about the antenna path at a substantially constant radius so that the effect of the heating element 28 upon the radiated energy remains substantially constant throughout the rotational cycle.

Moreover, by spacing the radial portion 133 of the antenna, and the heating element 28, at the same relatively close spacing to the adjacent (bottom) wall 22, there is minimum encroachment upon the space within the cavity; in other words, a high degree of compactness is achieved. In a practical case, the spacing of the heating element and antenna from the adjacent wall is on the order of one and one-half inch. By keeping the antenna within the confines of the bottom heating element, and with the latter distributed as shown in FIG. 2*a*, the antenna itself does not take up any additional space within the cavity, making the utilization of space much more efficient than where a stirring device or conventional type of rotating antenna is employed.

It will be understood, however, that the invention is not limited to the exact profile illustrated in FIG. 7*a* and, if desired, the slightly higher profile, illustrated in FIG. 10, may be used. In this embodiment, in which corresponding reference numerals are used with addition of subscript *a* to indicate corresponding parts of the device, the included angle *a* at the first bend 134*a* is increased and the included angle at the second bend 135*a* is decreased. Preferably the angle *a* should be kept within the range of 105° to 165°, while the in-

It is found that the structure described above produces a field which is so uniform and a result which is so predictable, that "formula cookery", based upon conventional cookbook instructions, is possible for the first time. Specifically, in the case of pastry and similar baked goods, the foodstuff, in normal quantity, is subjected to microwaves for a period of five minutes, after which baking is completed using thermal energy at the temperature, and in just one-half of the time, given in the conventional cookbook. In the case of other foods, both types of energy are applied from the beginning of the cycle and the total cooking time is reduced to one-quarter of that given in the cookbook.

What is claimed is:

1. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element at a normal temperature level for food preparation and at a high level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply including a blower and a magnetron having cooling fins, the blower having a blower inlet for drawing in cooling air and an outlet for supplying such air under slight pressure to the cooling fins, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, means defining air passages of limited cross section for conducting air from the magnetron into the waveguide so that a portion of the pressurized air passes through the waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a lever below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected from the blower inlet through the air passages into the waveguide and into the cavity for exiting through the cavity air vent notwithstanding the auto ignition pressure which exists in the cavity under high temperature self-cleaning conditions, the convention path of the air being sufficiently constricted so that air is convected in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of decomposition.

2. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element within a normal temperature range for food preparation and at a high temperature level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for supplying under slight pressure to the magnetron with discharge of at least a portion of the air into the housing to create slight pressure therein, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, means defining a pattern of small air passages from the housing to the waveguide so at least a portion of the pressurized air from the housing passes through the air passage and waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, all portions of the waveguide and housing including the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected from the blower inlet through the small air passages and waveguide into the cavity for exiting through the cavity air vent, the convection path of the air being sufficiently constricted so that air is convected in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of thermal decomposition.

3. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air from outside the housing for supplying under slight pressure to the magnetron, the cooling air being discharged from the magnetron into the housing for creating internal pressure therein, a waveguide coupled to the magnetron and extending along the housing and under the bottom wall of the cavity, the waveguide having an outlet alined with the opening in the bottom wall of the cavity, a hollow open-ended conductor extending through the opening for coupling the outlet of the waveguide to the cavity, means for securing the upper end of the hollow conductor to the bottom wall of the cavity and the lower end of the conductor to the waveguide for conduction of microwave energy into the cavity, the wall of the waveguide having a pattern of small openings communicating with the housing so that a portion of the pressurized air from the blower and magnetron passes through the waveguide and hollow conductor into the cavity for ventilating the cavity when the magnetron and blower are turned on, the housing having a relatively large vent opening through which the pressurized air therefrom passes outwardly to reduce the internal pressure in the housing thereby to reduce the flow of air through the pattern of small openings and into the cavity to a predetermined low level, the blower inlet and large vent opening being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on flow of air through the large vent opening is reversed in direction flowing inwardly through such vent opening into the housing and through the small openings via the waveguide into the cavity with final exiting through the cavity air vent.

4. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door en-

closing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for supplying under slight pressure to the magnetron, a waveguide coupled to the magnetron and extending under the bottom wall of the cavity, the waveguide having an outlet alined with the opening in the bottom wall of the cavity, a hollow open-ended conductor extending through the opening for coupling the outlet of the waveguide to the cavity, means for securing the upper end of the hollow conductor to the bottom wall of the cavity and the lower end of the conductor to the waveguide for conduction of microwave energy into the cavity, an antenna element centered in the hollow conductor and projecting into the cavity for guiding microwave energy to the latter, means for conducting at least a portion of the pressurized air from the blower and magnetron through the waveguide and hollow conductor into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is convected through the blower inlet, waveguide and hollow conductor into the cavity for exiting through the cavity air vent at the top thereof.

5. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space of conforming shape, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element within a normal temperature range for food preparation and at a high temperature level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for discharge under slight pressure to the magnetron, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, the waveguide being open to passage of cooling air from the magnetron so at least a portion of the pressurized air from the blower and magnetron passes through the waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected through the blower inlet, magnetron, and waveguide into the cavity for final exit through the cavity air vent at the top thereof, the air passage through the blower, magnetron and waveguide being sufficiently constricted so that the air is convected in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of thermal decomposition.

6. The combination as claimed in claim 5 in which the constriction in the air passage through the blower inlet, magnetron and waveguide is in the form of a pattern of small openings in the wall of the waveguide and in communication with the housing, the openings being of sufficiently small dimension so as to preclude the escape of microwave energy therethrough.

7. The combination as claimed in claim 6 in which the openings in the wall of the waveguide and the vent opening are sufficiently limited in total area as to limit the flow of air for microwave cookery to within the range of three to eight c.f.m. when the blower is on and to reduce the flow of convected air under baking and self-cleaning conditions to within the range of 0.5 to 2 c.f.m.

* * * * *

Feb. 25, 1969 E. M. TINGLEY 3,430,023

DOOR CONSTRUCTION AND VENTILATING SYSTEM FOR MICROWAVE OVEN

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FIG. 6

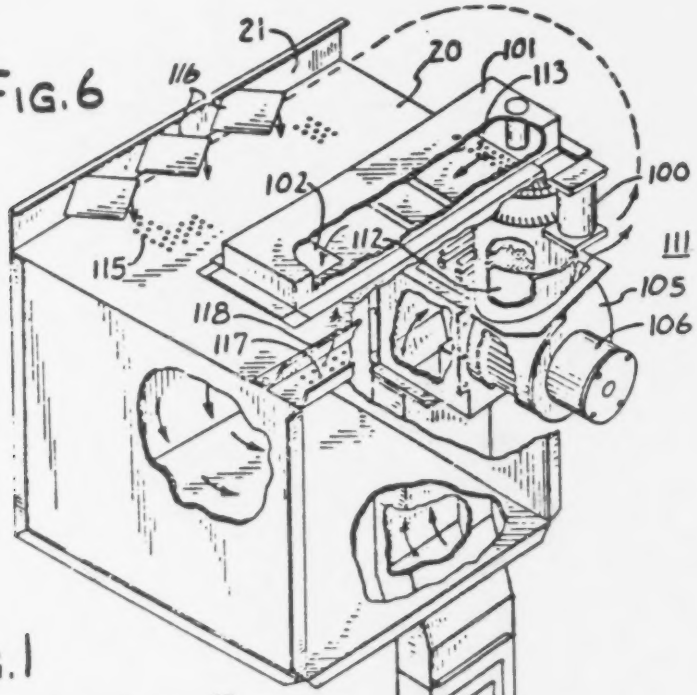
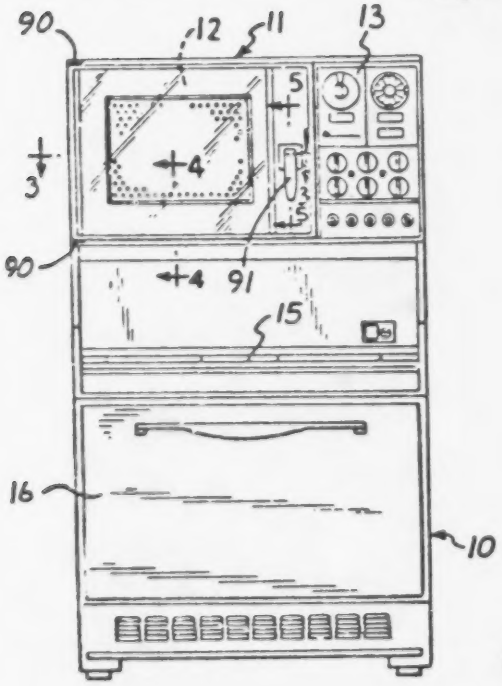


FIG. 1



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DOOR CONSTRUCTION AND VENTILATING SYSTEM FOR MICROWAVE OVEN

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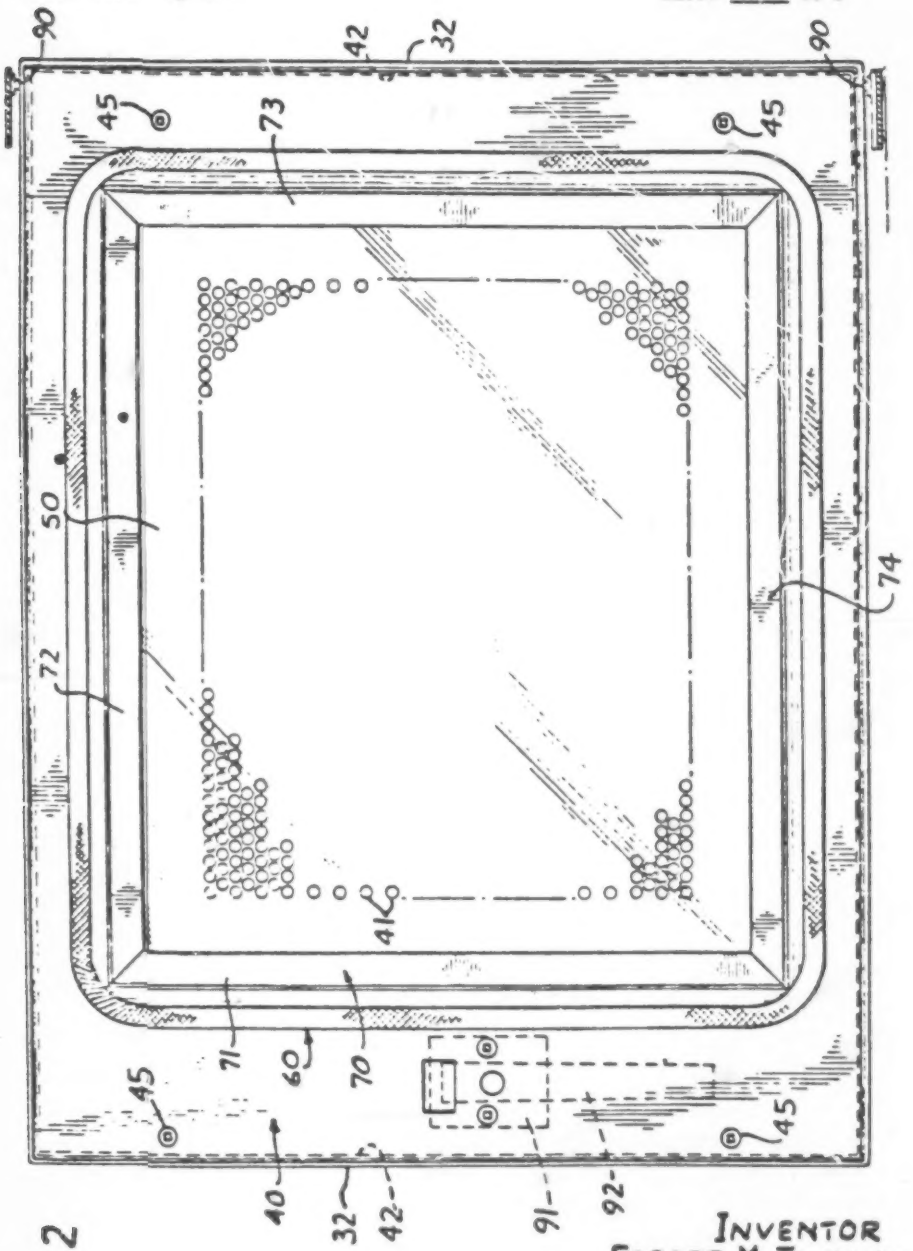

FIG. 2

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DOOR CONSTRUCTION AND VENTILATING SYSTEM FOR MICROWAVE OVEN

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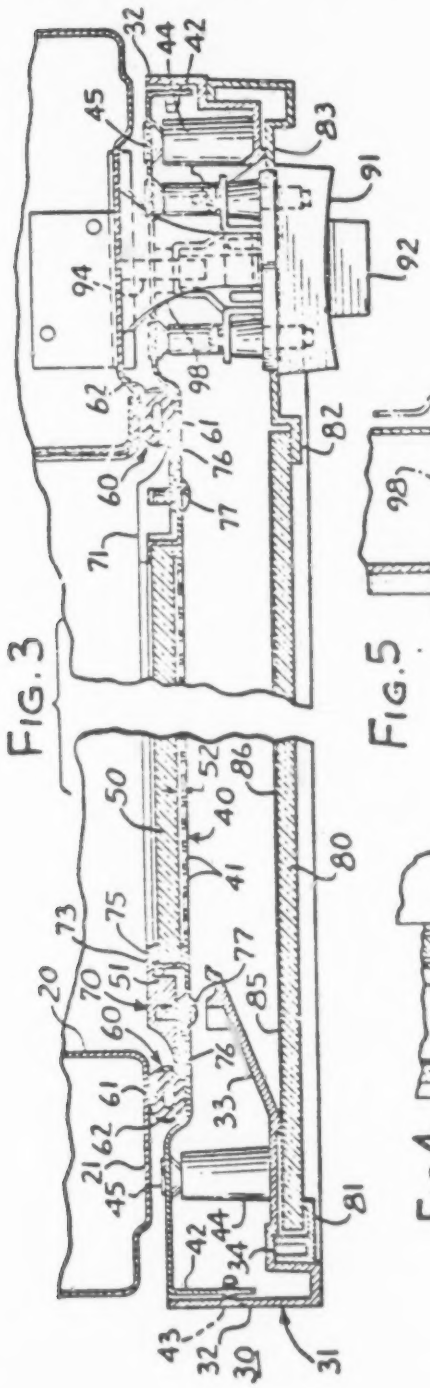

FIG. 3

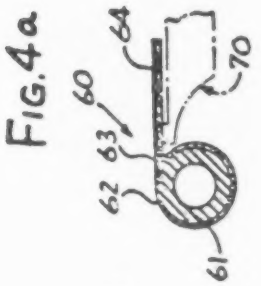

FIG. 4a

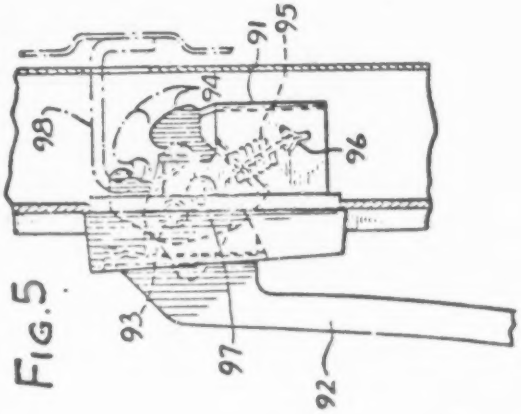

FIG. 5

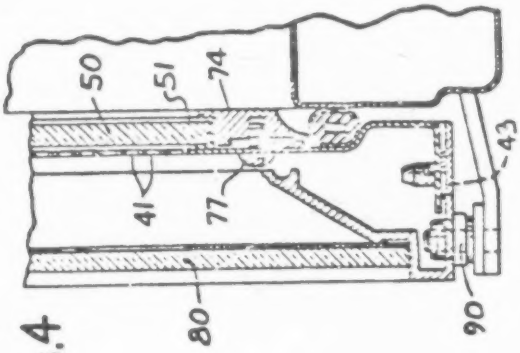

FIG. 4

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3,430,023

DOOR CONSTRUCTION AND VENTILATING SYSTEM FOR MICROWAVE OVEN

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U.S. Cl. 219—10.55 6 Claims
Int. Cl. H05b 9/06

ABSTRACT OF THE DISCLOSURE

A door construction for a microwave oven providing both a vapor seal and a seal against the escape of microwave energy from the oven cavity and a modified ventilating system for use therewith.

It is an object of the present invention to provide a door construction for a microwave oven which permits viewing of the contents of the oven but which nevertheless prevents escape of vapors and microwave energy from the oven cavity. It is a more specific object to provide a door construction which serves as a highly efficient microwave and vapor shield, consisting of a minimum number of parts which are simply formed and easily assembled but which form a door which is structurally strong and attractive in appearance. It is another object of the invention to provide a door which precludes flow of vapors through the perforations conventionally employed and which utilizes a modified ventilating system of increased effectiveness.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a front view of a range including a microwave oven incorporating the present invention;

FIG. 2 is a back view of the door employed in the oven of FIG. 1;

FIG. 3 is a section, broken for purposes of foreshortening, looking along the line 3—3 in FIG. 1;

FIG. 4 is a section taken along the line 4—4 in FIG. 1;

FIG. 4a is a cross section taken through the conductive gasket;

FIG. 5 is a fragmentary section taken through the latch mechanism and looking along the line 5—5 in FIG. 1;

FIG. 6 is a diagram showing the associated ventilating system.

While the invention has been described in connection with a preferred embodiment, it will be understood that I do not intend to be limited to the particular embodiment but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Turning now to FIGURE 1 there is shown a range 10 having a microwave oven 11 at the top with an oven cavity 12 and an adjacent control panel 13. Behind the control panel is a space for containing the microwave generating components as well as a blower system to which reference will later be made. Arranged below the microwave oven is a conventional cooking top 15. The lower part of the structure is formed by a conventional oven 16. The cooking top and conventional oven may be heated by either gas or electricity. Having both types of ovens in the same structure enables the two types of cookery to be carried on simultaneously.

The cavity 12 of the microwave oven has a liner 20 which is formed of conductive metal and which is continuous, free of any openings except the perforations required for admission and exhausting of air and the port for admission of microwave energy. The oven liner

is flanged outwardly to provide a front facing 21 of conductive metal which completely surrounds the front opening of the cavity.

In accordance with the present invention a door is provided for the oven having a peripheral frame and a conductive panel or liner which is centrally perforated and sealed by a rear cover glass, about which extends a continuous conductive gasket for engaging the facing of the oven cavity to prevent escape of both vapor and microwave energy. Further in accordance with the invention a seat is provided in the front edge of the peripheral frame for mounting a front cover glass to produce a rigid box-like construction while enabling the contents of the oven to be clearly viewed. Thus, turning to the drawings, the door of the microwave oven, indicated at 30, has a peripheral frame 31 of picture frame shape including a side flange 32 and an inwardly extending dished flange 33 which is recessed to form a peripheral seat 34. Extending over, and enclosing, the entire rear surface of the frame 31 is a conductive liner panel 40, the central portion of which is punched with a two-dimensional pattern of perforations 41 and the periphery of which is formed with a side flange 42. The latter is dimensioned for snug telescoping within the side flange 32 of the door frame, with the two parts being secured together by self-tapping screws 43. If desired for further rigidity the inner flange of the frame may be provided with a series of integral pedestals 44 engaged by screws 45 which penetrate registering countersunk openings in the liner panel.

For the purpose of covering the pattern of perforations 41, a rear cover glass 50 is used having a continuous vapor sealing gasket 51 which is of resilient material of U-shaped cross section. When the cover glass 50 is seated in position, the thickness of the vapor sealing gasket defines a thin space 52 maintaining the glass out of contact with the metal panel over the region of the perforations.

To seal the liner panel with respect to the front facing 21 of the oven cavity, a continuous gasket 60 is used (FIG. 4a) formed of resilient hollow tubing 61 which is surrounded by a wire mesh 62 stitched at 63 to define an anchoring web 64. The tubing is preferably made of heat-resistant synthetic rubber, for example of the silicone type, and the wire mesh may be of loose knitted construction using a gauge of wire which is sufficiently thin to provide a high degree of flexibility and of sufficiently wide mesh so as to preserve the vapor sealing effect of the rubber surface. The wire may, for example, be formed of a nickel-chromium alloy or of stainless steel.

In accordance with one of the aspects of the invention a subframe is provided surrounding the cover glass and having an inner clamping edge or flange which overlies and engages the peripheral edge of the cover glass and an outer clamping edge or lip which presses against the anchoring web 64 of the door sealing gasket 60. Referring to FIGS. 2 and 3, the subframe, indicated generally at 70, is formed of four separate sections 71–74 arranged closely end to end. The inner edge of each section has an integral lip or flange 75 which is suitably offset to accommodate the thickness of the vapor sealing gasket 51 and cover glass 50 while the outer edge of each section is provided with a raised clamping lip 76 for providing a localized line of pressure along the neck portion of the anchoring web 64 of the gasket 60. Each section is secured in place on the liner panel by a central row of screws 77. Since the sections of the subframe are independent of one another, each section is capable of self-adjustment, teeter-totter fashion, about the line of fastening so as to apply balanced concentrated forces to the cover glass and web of the gasket, respectively. The net effect is to insure that a sealing force is evenly applied about the entire periphery of the cover glass while insuring that a good electrical

and mechanical connection is obtained along the length of the conductive gasket 60. It has been found convenient, in manfacture, to employ a simple jig for assembling the parts together. First the sections of the subframe are laid in place on the jig, face down, topped by the cover glass and the web of the conductive gasket. The liner panel is then placed, face down, on the assembly with the fastening screws 77 being inserted and tightened. Following this it is a simple matter to telescope the liner panel into position within the peripheral frame.

To complete the assembly, an outer cover glass 80 is seated in the ledge 34 formed in the peripheral frame. The outer cover glass is engaged along its left-hand edge by a flanged insert 81 and along its right-hand edge by a flange 82 integrally formed in a panel 83. The cover glass 80 is preferably silvered along the edge as indicated at 85, leaving a clear central portion 86 for viewing through the perforations 41 in the liner panel.

For the purpose of mounting the door on the range, and for exerting sufficient clamping pressure in the closed position to compress the resilient gasket, I employ a simple form of hinge 90 along the left-hand edge and a latch mechanism 91 at the right-hand edge. While the latch mechanism does not per se form a part of the present invention, brief mention may be made of the mechanism with reference to FIG. 5. Here it will be seen that the mechanism 91 has a handle 92 which is pivoted at 93. A toggle member 94, also pivoted at 93 has an over-center compression spring 95 which is anchored at 96 and coupled to the toggle member at pivot 97. The toggle member engages a catch 98 which is secured to the frame of the oven. Thus when the door is closed the catch 98, striking the toggle member above its point of pivoting, causes the toggle member to snap over-center to the position shown, the spring 95 serving to apply an inward pull upon the catch 98, thereby compressing the gasket 60 evenly about its entire length. The conductivity of the wire mesh insures that there is electrical continuity between the oven liner and the door liner to preclude any escape of microwave energy. At the same time the convolutions of the wire forming the mesh are accommodated by the resilient surface of the rubber gasketing material so that an efficient vapor seal is preserved.

Experience shows that the above door construction not only brings about an efficient vapor and microwave seal but that the layers of glass spaced from one another on opposite sides of the rear panel, form a box-like structure which is self-reinforcing to provide a high degree of strength and mechanical rigidity. The structure is considered electrically and mechanically superior to the structures conventionally used and posseses the additional advantage that it can be manufactured at low cost. The assembly, including its partly silvered front cover glass, provides a richer more finished appearance than oven doors where the perforations are left uncovered for venting purposes.

In accordance with one of the more detailed aspects of the invention the sealed door is employed in conjunction with venting means which provides a well defined circulation path within the oven cavity. Thus, referring to FIG. 6, which is diagrammatic, the oven liner 20 is shown to the right of which is mounted microwave generating apparatus 100 which is coupled to the oven cavity by means of a wave guide 101 having a port 102. For the purpose of cooling the microwave generator and for inducing a well defined circulation of air in the oven cavity, a blower 105 is provided having a drive motor 106 and an air intake conduit 107. The output of the blower is split into two portions, a major portion 111 and a minor portion 112. The minor portion of the air is forced through suitable passages and cooling fins in the microwave generator following which the air is directed upwardly through perforations 113 into the waveguide 101 for discharge through the microwave port 102 into the oven cavity. The major portion of the air from the blower is directed into perforations 115 formed in the upper wall of the oven liner along the rear edge thereof. Although not specifically shown in FIG. 6, it will be understood that the air is conducted to the inlet ports 115 between the outer wall of the oven and the oven liner 20. In order to assist in directing the air downwardly through the perforations, a series of deflectors 116, arranged at an angle to the air stream, are provided.

For the purpose of venting the air which is forced into the oven cavity, a series of outlet perforations 117 are formed along the front edge of the upper wall of the oven liner. The perforations 117 are isolated from the inlet perforations 115 by an interposed vane or barrier 118. It is found that the major portion of the air follows a well defined circulation path, sweeping downwardly from the inlet perforations 115, forwardly within the cavity and thence upwardly along the sealed door surface for discharge through the perforations 117. The air from the microwave port 102 entering the central portion of the oven is turbulently mixed with the main air stream prior to venting through the perforations 117. The positive air flow pattern is to be contrasted with the usual door venting in which there is a simple drift of air through the door perforations. Following discharge the air and vapors may be allowed to enter the room or may be directed into an external discharge duct.

I claim as my invention:

1. In a microwave oven having structure defining a cavity with an opening surrounded by a front facing of conductive metal, a door for closing the opening and overlying the front facing comprising, in combination, a peripheral frame, a conductive liner panel secured to the rear of the frame for overlying the conductive facing, the central portion of the liner panel being perforated over an area, a rear cover glass covering the perforations and having a resilient vapor sealing gasket extending continuously about its edges, a resilient conductive gasket having a conductive web surrounding the cover glass, a subframe secured to the liner panel between the cover glass and the conductive gasket, said subframe having inner and outer clamping edges for respectively engaging the vapor sealing gasket at the edge of the rear cover glass and the web of the conductive gasket to clamp the same in place on the panel, and a front cover glass secured to the front of the peripheral frame.

2. The combination as claimed in claim 1 in which the subframe is of rectangular shape formed of four separate pieces having clamping lips along the edges and having fasteners spaced between the edges for exerting concentrated lines of pressure against the vapor sealing gasket and the web of the resilient gasket respectively.

3. The combination as claimed in claim 1 in which the subframe is of rectangular shape formed of four separate pieces of metal spaced closely end to end and each having a flange spaced from the panel along one edge overlying the edge of the glass for clampingly engaging the vapor sealing gasket and a lip along the other edge for clampingly engaging the web of the resilient conducting gasket, each piece of the subframe being separately secured to the panel by means of a central row of screws so that a concentrated line of pressure is simultaneously applied along the entire length of each of the gaskets for clamping the same in position.

4. In a microwave oven having structure defining a cavity with an opening surrounded by a front facing of conducting metal, a door for closing the opening and overlying the front facing comprising, in combination, a peripheral door frame having a side flange, a conductive liner panel having a side flange telescoped into the flange of the frame and having a central perforated area, a rear cover glass covering said perforations and having a resilient vapor sealing gasket extending continuously around its edges, a resilient conductive gasket formed of rubber surrounded by wire mesh, a subframe surrounding the glass and having screws for securing the same to the rear

surface of the liner panel, said subframe having clamping lips along the edges thereof for applying clamping pressure simultaneously to the vapor sealing gasket and the resilient conductive gasket upon tightening of said screws, said door frame defining a recessed seat along the front edge thereof, and a front cover glass having means for securing the same intimately seated on said seat for rigidifying the frame while permitting viewing of the oven contents through the perforations.

5. In a microwave oven having structure defining a cavity with an opening surrounded by a front facing of conducting metal, a door overlying the front facing comprising, in combination, a frame, an extensive liner panel of conducting metal having a central two-dimensional pattern of perforations, a rear cover glass plate for overlying the perforations, a resilient conductive gasket on said liner panel extending around the cover glass, the top wall of the cavity having a set of inlet perforations along its rear edge and a set of outlet perforations along its front edge, barrier means for isolating the two sets of perforations, means including a blower for applying pressurized air to the inlet perforations, means including a latch for maintaining the door in closed position with the conductive gasket compressed to prevent escape of air and vapor about the periphery of the door, said cover glass being sealed to the liner panel about its edges to prevent escape of air and vapor through the perforations in the door panel.

6. The combination as claimed in claim 5 including a microwave generator having a waveguide for conveying microwave energy to the cavity and providing passages for flow of cooling air, and means for diverting a portion of the air from the blower through said passages into the oven cavity.

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U.S. Cl. X.R.

126—200

April 22, 1969 H. BOEHM 3,440,386

MICROWAVE HEATING APPARATUS

Filed Nov. 21, 1966 Sheet 1 of 4

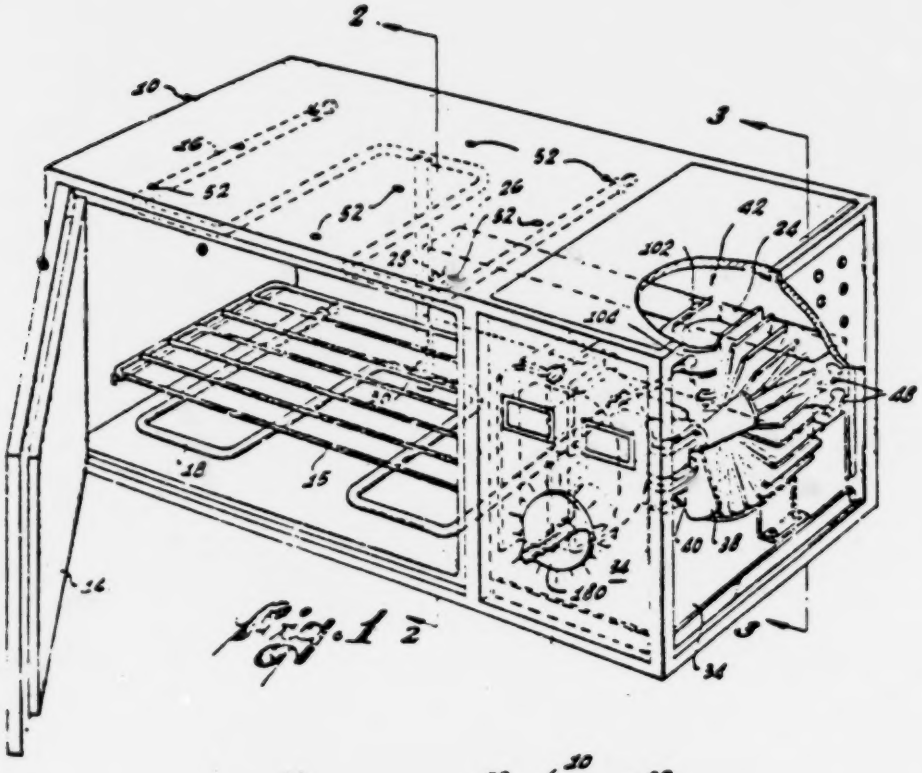

Fig. 1

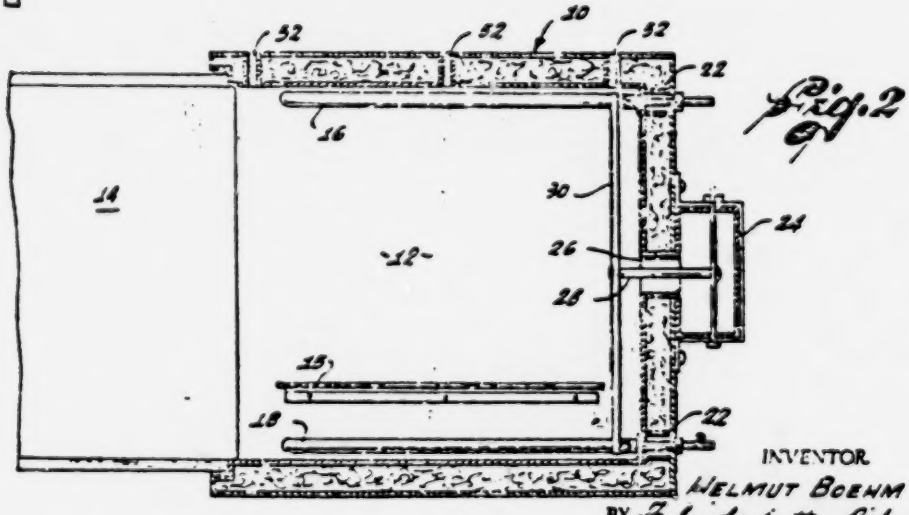

Fig. 2

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MICROWAVE HEATING APPARATUS

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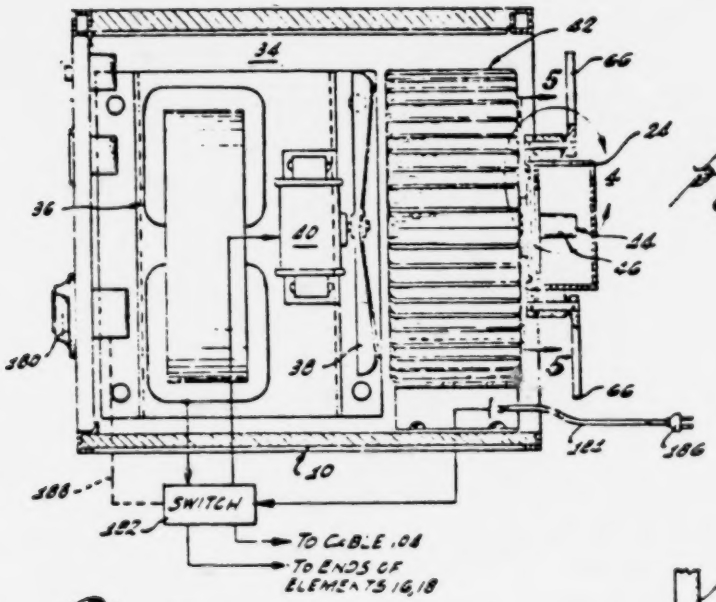


Fig. 3

Fig. 5

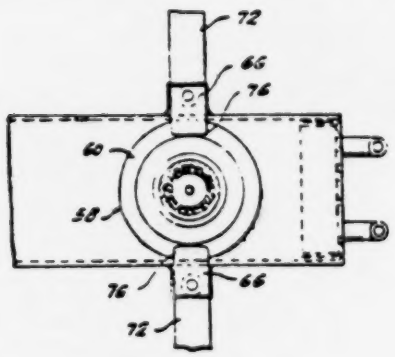
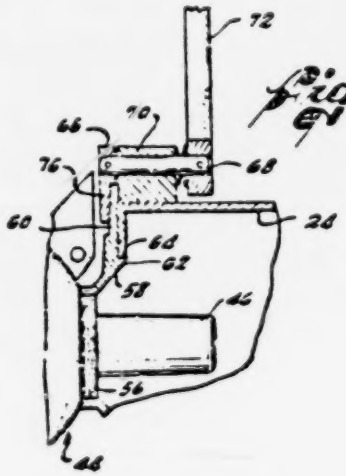


Fig. 4



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MICROWAVE HEATING APPARATUS

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Fig. 6

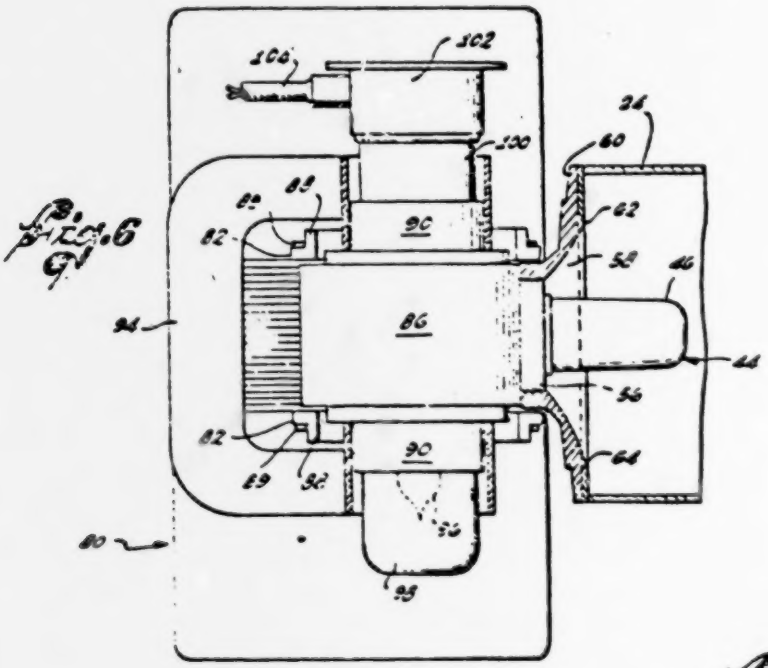


Fig. 8

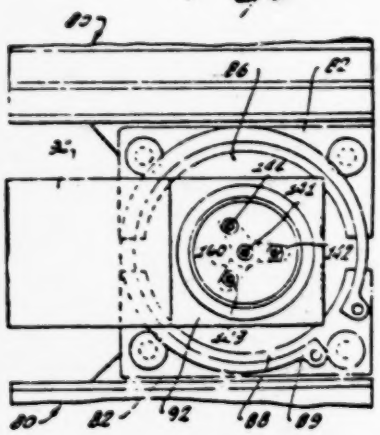
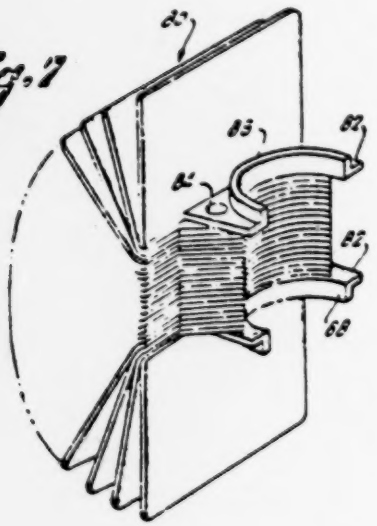


Fig. 7



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MICROWAVE HEATING APPARATUS

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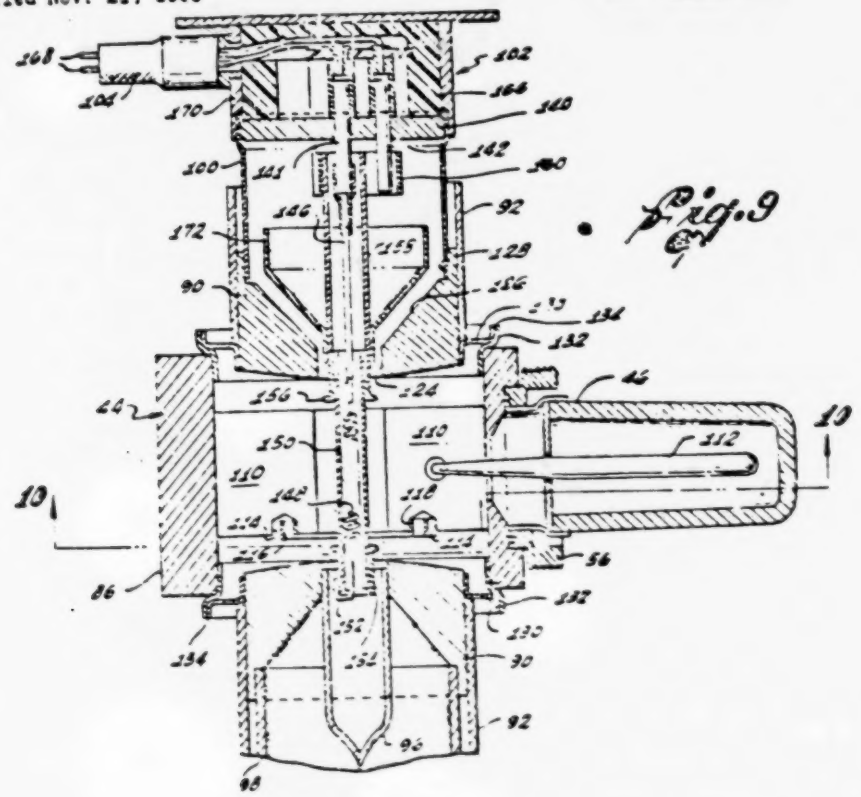

Fig. 9

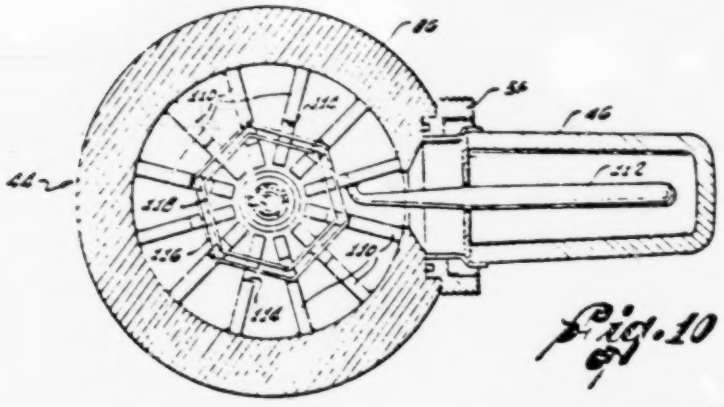

Fig. 10

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United States Patent Office 3,440,386 Patented Apr. 22, 1969

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3,440,386

MICROWAVE HEATING APPARATUS

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Int. Cl. H05b 9/06
U.S. Cl. 219—10.55 10 Claims

ABSTRACT OF THE DISCLOSURE

A waveguide has one opening into an oven chamber and a second opening for the output probe of a magnetron releasably attached thereto. Antenna elements in the chamber are connected to an output probe from said one opening. Adjacent said second waveguide opening, cooling means operates to cool the magnetron and direct air through the waveguide so as to force vapor in the chamber out of openings in its top wall. The antenna elements can be heated by electric current, and switch means controls connections of a power supply to the magnetron and an electric current source to the elements.

This invention relates to heating apparatus, and more particularly to improved apparatus for heating objects with microwave energy.

The apparatus of my invention will be described for cooking foodstuffs, but will be recognized as suitable for any use involving the application or utilization of microwave energy. More specifically, my invention will be described for cooking apparatus which utilizes a common element in an oven cavity for microwave cooking and/or conventional thermal cooking. Apparatus of this type is disclosed and claimed in my copending application, "Electronic Oven," Ser. No. 376,185, filed June 18, 1964, now Patent No. 3,320,396.

Such apparatus as heretofore known includes a resonant oven cavity with cooking elements therein, a magnetron for generating microwave energy, and waveguide connections for coupling the microwave energy to the elements. The elements function as traveling wave antennas to radiate the microwave energy throughout the cavity to cause foodstuffs placed therein to be cooked as desired. In addition, the elements are adapted to be heated in conventional fashion for thermal cooking. Further, circuit control means are provided for separately or simultaneously applying microwave energy and conventional heating current to the elements. The oven is provided with openings to the exterior, through which air may circulate and vapors from foodstuffs may escape without entering the waveguide system.

The present application is directed to constructions of parts of such apparatus to facilitate great economy and efficiency of manufacture, assembly, operation and maintenance thereof.

It is an object of my invention to provide an improved magnetron structure for use in microwave cooking apparatus.

Another object of my invention is to provide means utilizing the waveguide system of microwave cooking apparatus to prevent entry into such system of vapors from foodstuffs and facilitating escape of vapors from the oven of such apparatus.

Still another object of my invention is to provide means for releasably securing a magnetron structure to a waveguide structure without loss of microwave energy.

A still further object of my invention is to provide structurally cooperative magnetron and cooling fin structures with which to obtain optimum dissipation of heat generated in the magnetron structure.

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It is also an object of my invention to provide microwave cooking apparatus which comprises a minimum number of component parts of simple design and rugged construction.

The above and other objects and advantages of my invention will become apparent from the following description taken in conjunction with the accompanying drawings of an illustrative embodiment thereof, in which:

FIGURE 1 is a perspective view of microwave cooking apparatus in accordance with my invention, showing an arrangement for forcing air through the waveguide to enter the cavity and preventing grease and water vapors from entering the waveguide;

FIGURE 2 is a sectional view taken along the lines 2—2 of FIGURE 1, showing the output probe extending from the waveguide into the cavity, and a coupling member extending from the probe to the heater elements;

FIGURE 3 is a sectional view taken along the lines 3—3 of FIGURE 1, showing the magnetron structure releasably locked to the waveguide, with the output probe of the magnetron extending into the waveguide;

FIGURE 4 is an enlarged, fragmentary sectional view of the region 4—4 indicated in FIGURE 3;

FIGURE 5 is a side elevation view, taken along the lines 4—4 of FIGURE 3, showing the lock elements in engagement with the flange portion of the magnetron-waveguide coupler;

FIGURE 6 is a side elevation view of my magnetron structure with its anode nested in one portion of my cooling fin structure;

FIGURE 7 is a perspective view of one of the cooling fin packages which are clamped to the anode body;

FIGURE 8 is a fragmentary end view of the assembled magnetron and cooling fin structure as seen from the connector end;

FIGURE 9 is a longitudinal sectional view of my magnetron structure; and

FIGURE 10 is a sectional view taken along the lines 10—10 of FIGURE 9, showing the arrangement of my unique mode-stabilizing straps.

Referring to FIGURE 1, there is shown a cabinet 10 for microwave cooking apparatus having an oven chamber 12 and a door 14 through which to insert and remove foodstuffs. Foodstuffs are supported on a rack 15 in the chamber. Positioned above and below the rack 15, and adjacent the top and bottom surfaces within the chamber, are elements 16, 18, which are adapted to be excited by and to radiate microwave energy. Additionally, the elements 16, 18 may be connected to a current source and thereby heated so as to raise the temperature of the interior of the oven for cooking foodstuffs thermally in the conventional manner. For radiating microwave energy, the elements are directly coupled to a microwave source, thereby to function as traveling wave antennas for radiating the microwave energy throughout the resonant cavity defined by the oven chamber 12 and the closed door 14, thereby to cook the foodstuff in the cavity solely by microwave energy. Further, the elements 16, 18 may be heated by conventional current and/or excited by microwave energy, thereby to cause the foodstuff to be cooked by a combination of microwave cooking and/or thermal cooking.

Referring to FIGURE 2 along with FIGURE 1, the top, bottom, back and side walls of the chamber 12 are formed of insulated metal walls, which may, in a manner conventional for electric ovens, comprise inner and outer metal walls with insulation 20 between them. The terminals of the elements 16, 18 extend through and are anchored to the inner and outer metal walls at the back of the cabinet 10. If desired, spacer sleeves 22 may be provided intermediate such walls for additional support in securing the terminals in place. However, outer metal

walls and spacers 22 may be eliminated, in which case the insulation 20 is suitably secured to the cavity walls.

In the particular example shown, a waveguide 24 extends along the outer wall at the back of the cabinet 10, and has an opening in which a sleeve 26 is secured. The sleeve 26 forms part of a coaxial line, and is in electrical contact at its inner end with the back wall of the cavity. An output probe 28 extends from the interior of the waveguide 24, through the sleeve 26, and into the interior of the chamber 12, where it is connected to a vertical metal bar 30 that has its upper and lower ends conductively connected to the elements 16, 18.

In this latter connection, the elements 16, 18 may have a variety of shapes. In the particular arrangement shown, each element is formed with a U-shaped center portion in which the bend is located adjacent the rear wall of the chamber 12. Thus, the connecting bar 30 is located at the rear of the chamber, and hence is clear of the supporting rack 15.

In the embodiment shown, the waveguide 24 extends along the exterior of the back wall of the cabinet 10 and past the chamber 12 to the rear of a compartment 34. Referring to FIGURES 1 and 3, the compartment 34 houses a magnetron power supply 36, a fan 38 and its motor 40, and a cooling fin structure 42 supporting a magnetron 44 which has its output probe extending into a shield 46 that is inserted in the waveguide 24. As best seen in FIGURE 1, one or more air inlet pipes, shown as elbow pipes 48, extend from the end of the waveguide 24 and toward the interior of the compartment 34. Thus, air from the fan 38 passes through the cooling fin structure 42 and enters the waveguide through the pipes 48.

The pipes 48 are made sufficiently small to prevent leakage of microwave energy therethrough. With this arrangement, air blown past the cooling fins 42 is utilized both to enhance dissipation of heat from the magnetron through the fins, and also to project air through the waveguide 24 and into the interior of the oven chamber 12.

Extending through the top of the chamber 12 are a plurality of openings provided by cylindrical elements 52 (see FIGURE 2) inserted between the outer and inner metal walls. As with the pipes 48, the cylindrical elements 52 are sufficiently small to prevent undesired leakage of microwave energy from the chamber to the exterior of the cabinet 10. By thus forcing air through the waveguide 24 and into the chamber 12, I insure that grease particles and vapors from foodstuffs cooked in the chamber 12 cannot enter and contaminate the waveguide 24, but are instead forced through the openings in the top of the chamber and to the exterior of the cabinet. Further, such forcing of air through the waveguide aids in cooling the waveguide, as where the elements 16, 18 are heated by current to raise the temperature within the oven for thermal cooking. For preventing undesired matter from entering the waveguide, I prefer to operate the fan during microwave and/or thermal cooking.

The magnetron 44 is supported in the fin structure 42. Further, and in accordance with another feature of my invention, the magnetron is releasably locked to the waveguide 24. In this latter connection, and referring to FIGURES 3–5, a short, externally threaded element 56 is secured to the magnetron structure and surrounds the shield 46. A disc-like coupler element 58 is threaded onto the element 56, and is provided with a flange 60 that is undercut to form a reduced diameter axial shoulder 62 which is matingly received in an opening 64 in the confronting wall of the waveguide 24.

As shown, the inner face of the flange 60 abuts the confronting wall of the waveguide. The dimension of the abutting surface of the flange 60, i.e., the distance from the periphery of the shoulder 62 to the periphery of the flange 60, is at least a quarter of a wavelength of the microwave energy injected into the waveguide 24. In this manner, the annular space between the confronting walls of the shoulder 62 and the opening 64 is made microwave-tight, i.e., leakage of microwave energy between the abutting surfaces of the flange 60 and the waveguide 24 is avoided.

The flange 60 is releasably locked in place, and in the example shown this is accomplished by means of spring-biased lock elements 66. As best seen in FIGURE 4, the lock element 66 is carried on the end of a stub shaft 68 which extends through a body 70 that is secured to the top of the waveguide 24, e.g., as by brazing. At its outer end, the shaft 68 carries a handle 72, and spring biasing means, shown in the form of Belleville springs 74, is located between the handle 72 and the sleeve 70. Thus, the handle 72 and hence the shaft 68 and lock element 66, are biased to the right in FIGURE 4.

The lock element 66 has a tapered end which is adapted to be brought against the outer surface of the flange 60, by suitably forcing the handle 72 to the left against the bias springs 74, then rotating the handle to bring the extension 76 against the outer surface of the flange 60. Thereupon, the handle 72 is released to permit the biasing springs 74 to force the extension 76 against the flange 60, and thereby hold it against the confronting surface of the waveguide 24.

With this arrangement, it will be seen that I provide a means for easily and releasably locking the magnetron structure 44 to the waveguide 24. By simply rotating the handle 72 to remove the extension 76 from locking engagement on the flange 60, the magnetron is quickly disengaged from the waveguide for replacement or repair.

As previously mentioned, the magnetron 44 is supported in the cooling fin structure 42, and the magnetron and cooling fin structures are structurally cooperatively related to effect efficient heat dissipation. Referring to FIGURES 1 and 6–8, the cooling fin structure is formed of a pair of identical cooling fin packages 80. As best seen in FIGURE 7, each of the packages is a fan-shaped cooling fin structure formed of a plurality of heat dissipating elements, e.g., aluminum plates, which are stacked together at one end, and which are bent at different angles to form the desired fan shape. Plates 82 are positioned on the opposite ends of the stacked portions of the plates, and are suitably fastened together with the stack, as by rivets 84. The inner edges of the stacked portions of the plates are made circular, and the radius of curvature conforms to that of the anode body 86 of the magnetron 44 (see FIGURE 6). Each of the plates 82 is provided with an axial extension 88, to permit the cooling fin packages to be clamped to the anode body 86, as by locking or snap rings 89.

The magnetron structure 44 fits in the space between the confronting portions of the cooling fin packages. Referring to FIGURES 6 and 8, pole pieces 90 extend from the opposite ends of the anode body 86. Slidably placed over the pole pieces 90 are magnetic sleeves 92 which have flat external surfaces (see FIGURE 8). A U-shaped permanent magnet 94 is positioned on the side of the anode body 86 opposite the shield 46, with the flat surfaces at the ends of its legs placed against the confronting flat surfaces of the magnetic sleeves 92.

Referring to FIGURE 6, the magnetron is arranged to be evacuated through a tube 96 that extends through the lower pole piece 90, and such tube 96 is surrounded by a protective cover or shield 98 which extends into and is secured to the pole piece 90. Electrical connections to the magnetron are made through a tube 100 extending out of the upper pole piece 90. A connector 102 is fitted over the upper end of the tube 100, and a cable 104 extends from the tube for connection to the power supply.

Thus, the magnetron 44 is arranged so that all parts are located between the confronting plates of the two cooling packages. Such arrangement facilitates optimum surface-to-surface contact between the anode body 86 and the edges of the plates forming the cooling fin packages. In this latter connection, the circumferential length of the edges of the cooling plates which engage the anode body

86 are between one-fourth and one-half the circumference of the anode body.

As previously mentioned, the axial extensions 88 on the plates 82 are provided to be encircled by snap rings 89 for holding the cooling fin packages in place. In this connection, and referring to FIGURES 6 and 8, the plates 82 are located above and below the anode body 86, and the snap rings 89 encircle the extensions 88 on both plates 82, thereby firmly securing the cooling fin packages 80 in place.

To enhance contact between the abutting portions of the anode body 84 and the cooling fin packages 80, a suitable heat conducting material, e.g., a silicone grease, may be coated on the edges of the plates of the cooling fin structures before they are clamped to the anode body.

FIGURES 9 and 10 illustrate the details of internal construction of the improved magnetron of my invention. The magnetron is one having a strapped vane-type tuning cavity, and to this end there is brazed to the inner wall of the anode body or block 86 a plurality of space vanes 110, to one of which the probe 112 is brazed and extended out of the body and into the shield 46, all in a conventional manner.

However, I employ unique means for strapping the vanes for mode stabilizing purposes. In this connection, each of the vanes 110 is provided adjacent its inner end with a groove 114, the sides of which are straight and parallel and the bottom of which is V-shaped. Unlike conventional strapped vane magnetron cavities, wherein adjacent grooves are radially staggered, the grooves 114 in my improved structure are not staggered. As best seen in FIGURE 10, the inner sides of all the grooves 114 are spaced the same radial distance from the inner wall of the body 86. Similarly, the outer sides of all the grooves are spaced the same distance from the inner wall of the body.

Thus, all vanes 110 are made of the same dimensions, with grooves located in the same positions in all such elements. Accordingly, the vanes can be easily assembled by an operator without taking the time heretofore required to make certain that adjacent vanes have their grooves staggered.

Such ease of assembly of the vanes is made possible by my unique strapping arrangement. Twelve vanes are shown in the particular example, and alternate ones of these vanes are connected by respective outer and inner hexagonal straps 116, 118. The corner portions of the outer strap 116 are brazed to the outer sides of alternate grooves, and the mid-portions of the sides of the inner strap 118 are brazed to the inner sides of the remaining grooves. Inspection of FIGURE 10 will show that the corner portions of the inner strap are located inwardly of respective grooves, and do not touch the adjacent inner wall of such grooves. Also, the mid-portions of the sides of the outer strap 116 pass through alternate grooves without touching any portion thereof.

In addition, the shapes of the grooves 114 and straps 116, 118 facilitate assembly of the straps. The inner strap 118 preferably is dimensioned so that when it is slipped into the grooves, the mid-portions of its sides are in frictional engagement with the inner sides of the grooves to which such mid-portions are to be brazed. The strap is thus restricted against angular displacement prior to brazing. Also, since the bottoms of the grooves slope away from the sides thereof, the bottom edges of the mid-portions of the sides of the strap 118 come to rest against the outer end of the V, i.e., where the sides and bottoms of the grooves are joined.

The corners or angles of the outer strap 116 are similarly located in position against the outer sides of the grooves in which they are inserted. In assembly, the outer strap 116 is positioned with its corners aligned with those of the inner strap 118, which automatically orients the strap 116 properly for connection to alternate vanes. As with the other strap, the shape of the groove limits inner movement of the strap 116, and hence serves to locate it properly for brazing. Also, the strap 116 preferably is dimensioned so that slight force has to be exerted to force it inwardly, whereby its corners frictionally engage the outer sides of the grooves in which they are located. Such corner portions are then brazed and secured in place.

As previously indicated, the straps 116, 118 perform the usual mode stabilizing function. In this connection, my strap arrangement is one that is readily adjustable after assembly to provide such corrections as are necessary for the desired mode stabilization and resonance frequency. To this end, all that is necessary is to deform one or more portions of the straps intermediate the points at which they are brazed. Thus, one or more corner portions of the inner strap 118 and/or one or more of the mid-portions of the sides of the strap 116 may be forced inwardly or outwardly to change the capacitance of the straps as needed. Since the straps are ribbon-like metal elements, they retain such deformation.

For ease of manufacture and assembly, the pole pieces 90 are made identical. As best seen in FIGURE 9, each of the pole pieces is formed as a cylindrical element having a central opening that has a small cylindrical portion 124, a frusto-conical portion 126, and a recessed, enlarged diameter portion 128.

The pole pieces 90 are mounted in the anode block 86 with their rounded end faces extending into the ends of the block. In the arrangement shown, the pole pieces are secured at the ends of the block by means of flanged rings 130, 132 that are brazed, respectively, to the pole piece 90 and the block. In the particular arrangement shown, the rings 130 nest in the rings 132, and are welded together as indicated at 134, e.g., as by heliarc welding.

The tube 100 is supported in one of the pole pieces 90, as by inserting it in the enlarged diameter portion 128 of the opening therein, and brazing it to the pole piece. An end cap 140 is inserted in the outer end of the tube 100 and bonded thereto, and connector pins 141–144 (see FIGURES 8 and 9) extend through and are bonded to the cap. In the arrangement shown, the pin 141 extends through the center of the cap 140 and the pins 142–144 are spaced pins equidistant from the center pin 141.

Within the interior of the tube 100, the center pin 141 is connected to the heater lead 146 for a heater element 148 located in a sleeve cathode 150 that passes through the center of the vanes 110. The heater 148 is connected at 152 to an end shield 154 that is fitted around the cathode 150 at one end thereof.

A similar end shield 156 is fitted around the opposite end of the cathode 150, and a tube 158 is secured at one end to the shield 156. As shown, the tube 158 surrounds the heater lead 146 and the inner end of the connector 141, the outer end of the tube 158 being spaced from the inner face of the cap 140. Frictionally fitted around the outer end of the tube 158 is a clip element 160 which, as best seen in FIGURE 8, has outwardly extending legs which pass around and frictionally engage the connector pins 142–144. Thus, the connector pins 142–144 are connected together electrically.

Through the connector 102 and the cable 104, the heater 148 (via the pin 141) and the cathode 150 (via the pins 142–144) are adapted for connection to suitable heater and cathode potentials. To this end, the connector 102 is formed with an insulating body 166, through which leads 168 extend from the cable 104 for connection to respective pins 141, 142. In the arrangement shown, the ends of the leads 168 are supported in socket connectors frictionally fitted over the outer ends of the pins 141, 142. The body 166 is surrounded by a shield 170 which is frictionally fitted over the outer end of the tube 100.

The improved magnetron of my invention includes a novel choke structure for isolating the power supply from the microwave energy developed in the anode block 86.

To this end, I provide a tubular element 172 which has a surface configuration that generally conforms to the portions 124, 126, 128 of the opening in the pole piece 90. The element 172 has its smaller end fitted over the tube 158 and secured thereto adjacent its inner end, as by spot welding. The length of the element 172 is such that the length of the gap surrounding the element 172, measured from the outer end of the element 172 to the inner end of the pole piece 90, is a quarter-wavelength of the fundamental frequency of the energy generated within the anode block 86.

At such fundamental frequency, which for microwave cooking purposes preferably is in the region of 2,400 mHz., the confronting surface portions of all elements defining the gap, i.e., the portions of the elements 172 and the end shield 156 together with the confronting surface portions of the pole piece 90 and tube 160, function as a low impedance coaxial line at such fundamental frequency. Since such line terminates at the outer end of the element 172, the space within the tube 160 beyond the outer end of the element 172 constitutes an effective high impedance to the microwave energy. Accordingly, this construction forms an effective choke to prevent the microwave energy from being coupled through the pin connectors to the power supply.

In addition, the choke construction of my invention is adapted to minimize the effects of troublesome harmonics. In this connection it will be observed that the coaxial line above-mentioned is a stepped affair. The gap is smallest in the region of the portion 124 of the opening in the pole piece 90, is somewhat wider in the frusto-conical region thereof, and is widest along the enlarged diameter portion of the element 172. Such stepwise variations in the width of the gap, together with the differing lengths of the cylindrical and frusto-conical portions thereof, provide effective coaxial lines which are successive low-to-high impedance transformers. The dimensions preferably are selected to effectively isolate the most troublesome harmonics, e.g., the second and fourth harmonics.

After the magnetron is assembled, it is evacuated via the tube 96. The tube 96 is brazed at its inner end within the small diameter portion of the pole piece 90 in which it is inserted. After assembly of the magnetron, the tube 96 is connected to a vacuum pump for evacuating the entire structure in a conventional manner, following which the tube 96 is pinched off and closed at its outer end as indicated in FIGURE 9.

In addition to the advantages of my magnetron structure as above described, I achieve a marked improvement over prior art structures in the concentration of magnetic lines of force at the ends of the vanes 110. Since the inner ends of the pole pieces 90 are rounded, whereby their center portions are closest to the inner ends of the vanes 110, and since the pole pieces are inwardly tapered as described and have the greatest portion of their masses located immediately adjacent the ends of the vanes, they are effective to concentrate the flux from the magnet in the center portion of the anode block 86.

Any suitable switching means may be employed to effect cooking by microwave and/or thermal energy with the above-described apparatus. For example, one switch circuit may be provided for connecting the ends of the elements 16, 18 to a source of heating current, and another for connecting the power supply 36 to the magnetron connector cable 104. Such switch circuits may be operated by separate knobs, or by a single control knob as shown at 180 in FIGURE 1 on the front panel of the compartment 34.

In this latter connection, there is illustrated in FIGURE 3 a switch box 182 to which are connected the power supply 36 and a cord 184 having a plug 186 to be connected to the house current supply. The switch box 182 has output connections to the cable 104 and to the ends of the elements 16, 18. Switch circuits as referred to are included in the switch box, for operation in different positions of the knob 180, as through a mechanical connection 188 for operating movable contacts of the circuits.

Preferably, such circuits have some fixed contacts in common, so that in certain positions of the knob 180 there is cooking simultaneously by microwave and thermal energy. Still further, the fan motor 40 is preferably directly connected via the switch box 182 to the cord 184, through a switch that remains closed in all but the "off" position of the knob. In this manner, the fan is kept running at all times the oven is in use.

While the switch 182 and connections are shown schematically outside the oven structure in FIGURE 3, it is preferred that a corresponding physical structure be located in the compartment 34. In such case, a shaft from the switch box or housing preferably is on the axis of the knob 180 and directly connected thereto; the cord 184 extends through the compartment to the switch housing; the connections from the power supply 36 and the connections from the switch mechanism, to the fan 40 and the cable 104 are all leads confined in the compartment 34; and the connections to the ends of the elements 16, 18 are leads that extend from the switch housing through the rear of the compartment, from which they extend to and are secured to the terminals of the elements, projecting through the back of the oven structure.

From the foregoing, it will be apparent that various modifications can be made in the structures illustrated and described without departing from the spirit and scope of my invention. Accordingly, I do not intend that my invention be limited, except as by the appended claims.

I claim:

1. In combination:

a microwave cavity having openings to the exterior thereof through which to permit vapor to pass,

wherein said cavity is an oven chamber with a front door, said chamber having bottom, top, rear and side walls, the openings to the exterior of the cavity being in the top wall;

a conduit through which to introduce microwave energy into said cavity, comprising a waveguide,

said waveguide adjacent one end having an opening, said waveguide being mounted exteriorly of the rear wall, said rear wall having an opening aligned with the waveguide opening;

antenna means in said chamber;

an output probe extending through said waveguide opening and coupled to said antenna means,

said waveguide adjacent its other end having a second opening through which to introduce microwave energy into the waveguide;

a magnetron having an output probe extending into said second opening;

means releasably holding said magnetron and waveguide together; and

means to force air through said conduit and into the cavity at sufficient pressure to keep vapor in the cavity from passing into said conduit, such forced air aiding the escape of vapor through said openings.

2. The combination of claim 1, wherein said waveguide has an opening in said other end through which to admit air into the waveguide;

a pipe connection to said end opening; and

fan means for blowing air into said pipe connection.

3. The combination of claim 1, wherein said antenna means includes an element which is adapted to be heated by electric current;

means to supply electric current to said element;

a power supply for said magnetron; and

switch means operable for connecting said element to a source of electric current and for connecting said power supply to said magnetron separately or simultaneously.

4. The combination of claim 3, including means for operating said fan means at all times during operation of said switch means.

5. The combination of claim 1, wherein said magnetron has a cylindrical anode block, said magnetron output probe extending out of the lateral surface of said block;

a pair of pole pieces extending out of the ends of the block;

an evacuation tube extending out of one pole piece;

an electrical lead support tube extending out of the other pole piece; and

a permanent magnet extending along and spaced from said block opposite said magnetron output probe and having its ends engaging said pole pieces.

6. The combination of claim 5, further including;

a pair of cooling fin packages formed of stacked plates, the plates at one edge of each stack being curved with the same radius of curvature as said block, said packages being located on opposite sides of said block with the curved plates of each package extending a quarter of the circumference of said block; and

means to hold said packages with the curved edges of the plates thereof in contact with the lateral surface of said block.

7. The combination of claim 6, including a pair of magnetic sleeves surrounding said pole pieces, said sleeves having a flat external surface, said magnet being U-shaped and having flat faces at the ends of its legs engaging said flat external surfaces.

8. The combination of claim 6, wherein the plates of each package are shaped to define a fan-shaped cooling package;

C-shaped plates secured at the opposite ends of each stack of plates; and

snap-rings encircling corresponding C-shaped plates of said packages and to releasably hold the curved edges of said plates against said block.

9. The combination of claim 5, including:

a circular element surrounding said magnetron output probe and extending from said block, the exterior portion of said circular element being threaded;

a disc element threadedly secured to said circular element, said disc element having a circular shoulder slidable in said second waveguide opening, said disc element having a face abutting said waveguide around said second waveguide opening, the radial dimension of said face being at least a quarter wavelength of the microwave energy propagated through said waveguide; and

means for releasably clamping said disc element and waveguide together.

10. In combination:

a microwave cavity having openings to the exterior thereof through which to permit vapor to pass, wherein said cavity is an oven chamber with a front door, said chamber having bottom, top, rear and side walls, the openings to the exterior of the cavity being in the top wall;

antenna means in said chamber;

a source of microwave energy;

a waveguide outside said cavity and having an input opening coupled to said source, said waveguide having an output opening;

means for directing microwave energy at said output opening solely to said antenna means to cause said antenna means to radiate microwave energy throughout said cavity; and

means to force air through said waveguide into said chamber at sufficient pressure to keep vapor in the chamber from passing into said waveguide, such forced air aiding the escape of vapor through said openings.

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RÉPUBLIQUE FRANÇAISE

MINISTÈRE DE L'INDUSTRIE

SERVICE de la PROPRIÉTÉ INDUSTRIELLE

BREVET D'INVENTION

P.V. n° 819.462 — N° 1.249.136

Classification internationale : F 24 c — H 05 b

Cuisinière électrique avec dispositif complémentaire à micro-ondes.

Société dite : MIWAG MIKROWELLEN AG résidant en Suisse.

Demandé le 24 février 1960, à 16h 29m, à Paris. 15 März 1961

Délivré le 14 novembre 1960.

(*Demande de brevet déposée en République Fédérale Allemande le 25 février 1959, sous le n° D 30.068 VIII/d 21 h, au nom de* Société dite : DEUTSCHE MIKROWELLEN Gesellschaft m. b. H.)

On connaît des appareils dans lesquels on peut chauffer dans une enceinte métallique fermée des denrées alimentaires au moyen de micro-ondes et dans lesquels on peut faire rissoler ou dorer ces denrées suivant les besoins ou suivant le goût du consommateur au moyen de rayons infrarouges. Dans beaucoup de cas, on peut obtenir une amélioration par rapport aux procédés de cuisson ordinaires pour ce qui concerne le goût, les qualités nutritives et l'aspect des aliments. Une utilisation particulière des appareils en question est constituée par le dégourdissement et le chauffage rapides d'aliments déjà cuits, préparés en portions prêtes à être servies, puis refroidis. Dans les cuisines des hôtels, des sanatoriums et des hôpitaux, il est possible de loger en supplément ces appareils qui prennent beaucoup de place. Mais dans les installations domestiques, on n'arrive pas, la plupart du temps, à loger de tels appareils en raison du manque de place.

L'invention concerne une cuisinière électrique d'un type et de dimensions classiques, avec plaques chauffantes et four avec dispositif pour les grillades. Elle est caractérisée par le fait que dans l'espace se trouvant au-dessous du four, entre les pieds de la cuisinière, sont disposés un générateur de micro-ondes et son dispositif d'alimentation en courant, générateur à partir duquel l'énergie des micro-ondes est amenée au four par l'intermédiaire d'un guide d'ondes disposé le long d'une paroi latérale du four et par l'intermédiaire d'une fente ou moins.

La cuisinière n'a donc pas besoin d'être construite avec des dimensions plus grandes que celles de la cuisinière domestique normale. Elle ne demande pas de la place supplémentaire dans la cuisine. En outre, il y a suppression des frais accessoires pour la caisse, la chambre et le branchement électrique d'une cuisinière supplémentaire à micro-ondes. A l'exécution de série de la cuisinière électrique normale, il suffit d'apporter quelques modifications légères pour ce qui concerne le four, l'équipement en interrupteurs et l'installation.

Le guide d'ondes pour l'amenée de l'énergie des micro-ondes peut être disposé avantageusement contre la paroi postérieure de l'enceinte du four, une fente étant prévue à peu près au milieu de ladite paroi. Les dimensions à donner aux guides d'ondes de ce genre et aux fentes d'accouplement sont connues d'après la littérature spécialisée.

Le tube électronique générateur qui est habituellement un magnétron refroidi par de l'air ainsi que la partie de réseau correspondante pour l'alimentation en courant sont par conséquent logés maintenant dans la zone la plus froide de la caisse, au-dessous du four dans l'espace se trouvant entre les pieds de la cuisinière, espace qui autrement, ne serait pas utilisé. Cette disposition facilite d'une manière considérable la solution du problème du refroidissement. Le courant d'air fourni par un ventilateur normal suffit en effet pour assurer ce refroidissement.

Suivant l'invention, une partie de l'air de refroidissement est refoulée, à travers des ouvertures ménagées à cet effet, dans le guide d'ondes d'où elle s'échappe en passant à travers la fente d'accouplement, le four et les ouvertures d'aération de ce dernier. Cette construction suivant l'invention sert à protéger le tube électronique générateur. Sans cette construction, des vapeurs et des fumées de graisse se déposeraient dans la tubulure d'accouplement du tube électronique et dans le guide d'ondes, ce qui conduirait à des perturbations dans la marche de la cuisinière. Il n'est pas possible de disposer une fenêtre diélectrique avant la fente de couplage ou dans la fente de couplage étant donné que cette fenêtre serait, elle aussi, soufflée et que par conséquent, l'adaptation serait endommagée. Afin qu'il ne se produise pas, lors du fonctionne-

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ment du four sans micro-ondes, un revêtement de la tubulure de couplage et du guide d'ondes, ce qui, lors d'un fonctionnement ultérieur avec micro-ondes, aurait aussi les conséquences indiquées plus haut. Les circuits des éléments chauffants disposés dans le four et le circuit du moteur du ventilateur passent par un interrupteur commun. De cette manière, la protection du tube électronique générateur est assurée pour tout mode de fonctionnement du four.

Conformément à l'invention, il est prévu parallèlement à la paroi latérale portant la fente de couplage ou les fentes de couplage, une plaque réfléchissante plus petite que la paroi latérale et disposée d'une manière telle qu'il se forme entre ladite plaque et les parois avoisinantes, un intervalle annulaire. Pour régler l'adaptation, on peut faire varier la distance entre la plaque réfléchissante et la paroi latérale portant la fente et pour agir sur la répartition du champ dans le four, on peut faire varier les largeurs de l'intervalle annulaire par un mouvement de translation. La partie centrale de la plaque réfléchissante est en retrait dans la direction orientée vers la porte du four et les bords de la plaque réfléchissante sont recourbés. Au voisinage de la fente de couplage, la paroi latérale fait saillie vers l'extérieur, à peu près symétriquement par rapport à la plaque réfléchissante. Les saillies respectives et opposées de la plaque réfléchissante et de la paroi latérale fournissent une largeur de variation plus grande pour l'accord. Le réglage de l'adaptation appropriée et le réglage de la répartition de champ désirée sont plus commodes à exécuter parce que de petites modifications de position de la plaque réfléchissante ne sont pas aussi critiques. Le contact thermique entre la paroi du four et le guide d'ondes est plus faible que lorsque la paroi latérale est plane et le four peut être mieux isolé extérieurement contre les pertes de chaleur.

Les barreaux du gril sont disposés d'une manière telle que le gril, pour la direction de polarisation principale régnant dans le four, est perméable au champ. Dans le mode d'alimentation haute fréquence qui a été montré ici, il faut donc, par exemple, que les ouvertures entre les barreaux soient, dans leur direction longitudinale, parallèles à la direction longitudinale de la fente d'alimentation. Afin que soient évitées des pertes haute fréquence indésirables, le gril est supporté, avec isolation, par les parois latérales. On peut supporter le gril en disposant des points d'appui isolants ou bien, le gril étant revêtu d'un bon émaillage, le faire reposer sur des nervures d'appui des parois latérales.

Au-dessous du four est logée aussi la partie de réseau pour l'alimentation en courant du tube électronique générateur, partie de réseau dont le transformateur haute tension est subdivisé en deux transformateurs distincts dont les enroulements secondaires sont montés en série. Conformément à l'invention, l'un des deux transformateurs haute tension, quand le tube électronique est prêt à fonctionner, demeure en permanence sous tension côté primaire et sa tension secondaire fournit à la cathode une charge préalable faible pour laquelle l'état d'oscillation n'est pas encore atteint.

Comparée à l'exécution normale avec un transformateur haute tension seulement, cette disposition présente des avantages importants. En raison de la faible charge préalable de la cathode avant que soit atteint l'état d'oscillation lors de la mise en service, on évite d'une manière sûre les perturbations produites par ce qu'on appelle la « maladie du sommeil » du magnétron. Du côté primaire du transformateur haute tension qui, lorsque le magnétron est prêt à entrer en service, c'est-à-dire chauffé, il est prévu une série de prises pour le réglage des tensions de service, ce qui permet d'effectuer ce réglage avec des moyens de couplage faiblement chargés, étant donné que l'un des transformateurs montés en parallèle côté primaire n'a besoin de transmettre que la moitié environ de la puissance nécessaire côté haute tension. D'autres avantages de cette disposition de réseau résident en ce que le refroidissement est plus favorable en raison de l'épaisseur plus faible des différents enroulements et en ce que la hauteur de construction et le poids sont plus petits.

Sur les figures 1 à 3, on a représenté un exemple de réalisation de l'invention, en tenant compte seulement des éléments qui ont un rapport avec le four de la cuisinière.

La figure 1 représente le four avec guide d'ondes et avec magnétron refroidi par l'air, tel qu'il apparaît à un observateur regardant la face arrière de la cuisinière;

La figure 2 montre une coupe de l'appareil faite suivant la ligne A-B de la figure 1;

La figure 3 montre schématiquement les barreaux du gril, dans cette réalisation de l'appareil.

1 désigne les parois du four de la cuisinière. La porte 2 ferme l'ouverture du four. Le réchauffeur 3 du gril est fixé à des isolateurs 4. Pour que le dessin soit plus clair, on n'a pas représenté les dispositifs normaux pour la marche à plein régime ou à régime modéré du four. Le magnétron 5 est représenté avec son aimant et ses tôles de refroidissement. La tubulure 6 de couplage fait saillie d'une manière connue, de $\lambda/4$ environ, dans le guide d'ondes 7. La fente 8 est disposée dans le milieu de la paroi postérieure, à profil en saillie, du four, et à un endroit approprié du guide d'ondes. Vis-à-vis de la fente 8, on a représenté, parallèlement à la paroi postérieure du four, la plaque réfléchissante 9 qui est à peu près symé-

trique et dont les bords a et recourbés. Le ventilateur 10 souffle l'air de refroidissement entre les tôles de refroidissement du magnétron. Une partie de l'air de refroidissement est refoulée à travers les ouvertures 11 dans le guide d'ondes 7 d'où elle s'échappe en passant par la fente 8 et une ouverture ménagée dans la paroi du four en entraînant les vapeurs et les fumées de graisse. Le trajet de l'air est indiqué par des flèches. Les nervures d'appui 12 portent le gril 13 qui a été représenté en traits interrompus. La disposition des barreaux de gril est indiquée sur la figure 3.

RÉSUMÉ

Cuisinière électrique du type et de dimensions classiques avec plaques chauffantes et four avec dispositif pour les grillades, cuisinière électrique caractérisée par les points suivants, séparément ou en combinaisons :

1° Dans l'espace se trouvant au-dessous du four, entre les pieds de la cuisinière, sont disposés un générateur de micro-ondes et son dispositif d'alimentation en courant, générateur à partir duquel l'énergie des micro-ondes est amenée au four par l'intermédiaire d'un guide d'ondes disposé le long d'une paroi latérale et par l'intermédiaire d'une fente au moins ;

2 Le guide d'ondes est disposé contre la paroi postérieure et une fente est disposée à peu près au milieu de ladite paroi ;

3° Devant la paroi latérale portant la fente ou les fentes de couplage et, à une faible distance de ladite paroi, est disposée une plaque réfléchissante dont les dimensions sont plus petites que celles de la paroi latérale, cette disposition étant réalisée d'une manière telle qu'il se forme entre la plaque réfléchissante et les parois qui en sont voisines, un intervalle annulaire ;

4° Pour des fins d'adaptation, on peut faire varier la distance entre la plaque réfléchissante et la paroi latérale portant la fente et, pour agir sur la répartition du champ dans le four, on peut faire varier les largeurs de l'intervalle annulaire ;

5° La zone centrale de la plaque réfléchissante est en retrait et les bords de cette plaque sont recourbés ;

6° La paroi latérale, au voisinage de la fente ou des fentes, fait saillie, vers l'extérieur, en forme de cuvette ;

7° Il est prévu un refroidissement par ventilateur pour le tube électronique générateur et une partie de l'air de refroidissement est refoulée dans le guide d'ondes ;

8° Les circuits des éléments chauffants disposés dans le four et le circuit du moteur du ventilateur passent par un interrupteur commun ;

9° Les barreaux du gril sont disposés d'une manière telle que ledit gril est perméable au champ dans la direction de polarisation principale régnant dans le four ;

10° Le gril est supporté par les parois latérales dont il est isolé ;

11° Dans le cas où il est prévu un couplage de démarrage et un couplage de service pour la partie réseau d'un émetteur électronique et en particulier d'un émetteur à magnétron dans lequel le transformateur haute tension pour la tension anodique du tube électronique est subdivisé en deux transformateurs distincts dont les enroulements secondaires sont montés en série, l'un des transformateurs haute tension, lorsque le tube électronique est prêt à entrer en service, est en permanence raccordé côté primaire à la tension du réseau et sa tension secondaire à une valeur telle qu'il est fourni à la cathode une faible charge préalable pour laquelle l'état d'oscillation n'est pas encore atteint et l'enroulement primaire du second transformateur est raccordé en pleine marche à la tension du réseau ;

12° Il est prévu côté primaire du transformateur haute tension, qui à l'état de démarrage est seul sous tension, une série de prises pour le réglage des tensions de marche secondaires.

Société dite : MIWAG MIKROWELLEN AG

Par procuration

SIMONNOT, RINAY et BLETZGELL

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Fig.1

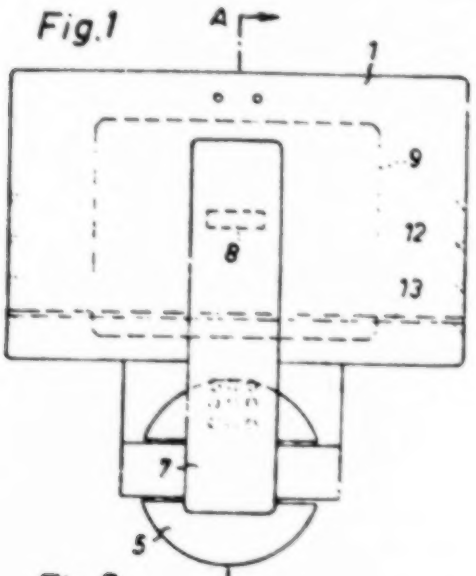
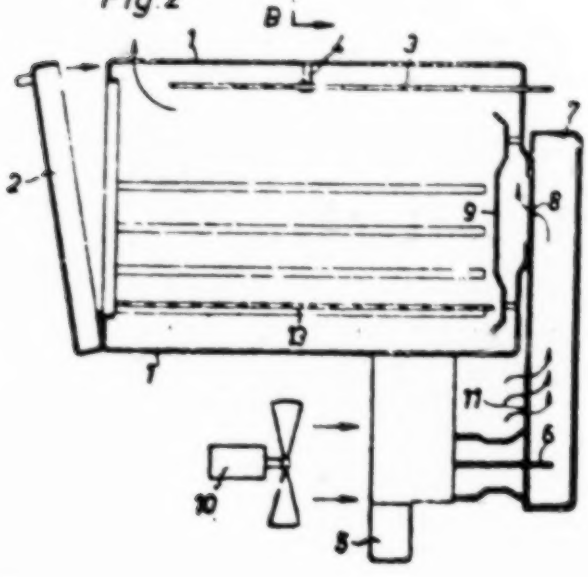


Fig.2



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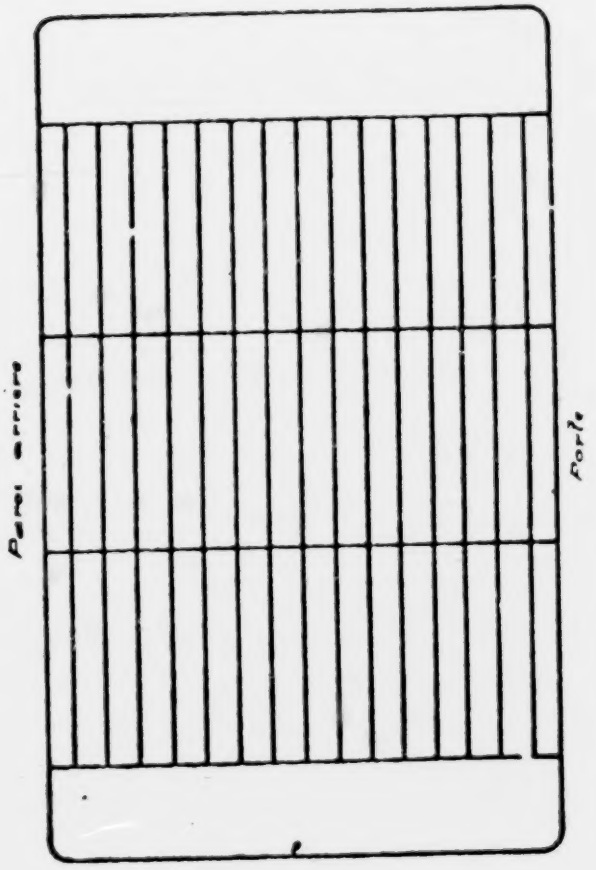

Fig.3

France.....

Patent 1249130, International Classes F 24 c - H 05 b

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Granted November 14, 1960.

Assigné: MIWAG MIKROWELLEN AG, a denizen of Switzerland.

Priority claimed for Western Germany as of February 25, 1959(Ser. No. of application there: D 30.063 VIII d/21 h); name of assigné there: Deutsche Mikrowellen GmbH.

Electric Cooking Stove with an Additional Microwave Device

One knows already equipment where one may heat inside a closed metal container articles of food under use of microwaves and where one may brown or glaze the foodstuffs as needed or so as to suit the taste of the consumer, using infrared rays. In many cases one gets an improvement compared to the ordinary manner of cooking what concerns the taste, the nutrient qualities and the looks of the food. A special use of such equipment is the taking- off of the chill and the rapid heating of food which is already cooked and prepared in meal- - sized portions ready to be served, and frozen after their preparation. In kitchens of hotels, sanitaria and hospitals one uses a greater number of such pieces of equipment which then take up lots of space. Therefore in the households one often cannot prevail oneself of such an equipment, siply because there is lack of space.

The present invention has as subject- matter an electric kitchen stove of the type and dimensions comm-

only used, with heating plates and an oven with equipment for grilling. It is characterized in that in the space located underneath the oven, between (and among) the feet of the kitchen stove is located a generator for for microwaves and its device for current supply, from which generator the energy of the microwaves is supplied to the oven by aide of a waveguide which is located at a lateral wall of the oven, so that the microwaves may pass along through at least one slot.

This means that this kitchen stove needs not to be constructed with unusually large dimensions, i.e. such greater than the ordinarily present kitchen stove. Then also no money has to be spent for the box, the chamber and the electric leads of an additional kitchen stove for microwaves, If one is in the process of producing a greater number of the ordinary electric kitchen stoves, all one has to do is to apply some slight modifications at the stove itself, place certain circuit- - breaker(s) and pay for the installing thereof.

The waveguide for transferring the microwave enorgy should preferably be located against the rear ~~wall~~ portion of the surrounding wall or enclosure of the ~~stove~~ oven, and at least one ~~such~~ slot is located close to the middle of this wall portion. The dimensions with which such waveguides are to be endowed and also the kinds of energy- transfer slots to be shaped are known in the pertinent literature.

The electronic generator tube which mostly is a magnetron which is cooled by air and also the portion of the circuit needed for supplying current thus would

have to be located in the coldest zone of the stove's body, below the oven in the space between and among the oven's feet, a space which otherwise is not used for anything. This placing renders the problem of cooling much easier, a stream of air coming from an ordinary air blower is all what is needed to bring about such cooling.

According to the invention a portion of the cooling air is pumped across openings which have been machined for this very reason into the wave guide through which it flows so that next it moves along the coupling slot, the oven and the aeration openings of this one. This construction according to the invention serves to protect the electronic generator tube. If one would not construct like this then vapors and grease fumes would become precipitated in the connection tubing for the electronic tube and inside the wave guide, what would lead to trouble in the operations of the kitchen stove. One cannot place a dielectric window ahead of the connecting slot because such a window would simply become dirty thus its operation and purpose would become impaired. In order to avoid that, whensoever the oven is used without microwaves, a coating becomes deposited in the connecting tubing and the wave guide, the construction is visualized like this...also with the idea that later on an operation with microwaves will not lead to the bad effects mentioned above.....that the circuits of the heating elements which are contained in the oven and the circuit of the motor for the blower pass through a common circuit- breaker. In this way

the protection of the electronic generator tube is brought about for any kind of operations of the oven.

According to the invention one furthermore installs in parallel to the lateral portion which carries the one or the several coupling slot(s) a reflector plate which is smaller than said lateral portion and installed like this that there becomes formed between this plate and the adjacent wall portions an annular space. In order to regulate the adaptation one may let vary the distance between the reflector plate and the lateral wall portion which has the slot, and in order to act upon the distribution of the field in the oven one may let vary the width of the annular space by a translatory motion. The central portion of the reflector plate is receding in the direction going towards the oven door, and the edges of the reflector plate are bent. Close to the coupling slot the lateral wall protrudes outwardly, more or less symmetrically with respect to the reflector plate. The corresponding opposite protrusions of the reflector plate and of the lateral wall portion define a greater adjustment width so that one is able to tune. The regulations of the right adapting and also of the desired field distribution are easier to achieve because small changes in the position of the reflector plate are not too critical. The thermal contact between the oven wall and the waveguide is smaller than this would be the case for a flat lateral wall portion, and it is easier to insulate the oven outwardly against heat losses.

The bars of the grill are arranged in such a manner

that the g. .le for the main direction of polarization existing in the oven is permeable for the field. With the high- frequency supply discussed here it thus will become necessary e.g. that the openings between (and among) the bars must in the longitudinal direction be parallel to the longitudinal direction of the feed slot. In order to avoid undesirably high high- frequ - ency losses the grill is carried, with placing of the suitable insulation, by the lateral wall portions, and one may let the grill be carried by placing suitable insulators or, if the grill is coated with a good layer of enamel then it may be carried by supporting ribs in the lateral wall portions .

Below the oven is also located the circuit portion for supplying current to the electronic generator tube, and the high- voltage transformer for this circuit portion is subdivided into two individual transformers the secondary windings of which are connected in series. According to the invention one of the two high- voltage transformers, when the electronic tube is ready to be put on stream, remains permanently under the voltage of the primary side, and its secondary voltage furnishes to the cathode a weak preliminary charge for which the state of oscillation (alternating) has not yet been reached.

In comparison with the ordinary construction with one high- voltage transformer only this setup offers sign - ificant advantages. Due to the weak preliminary (start- er) charge of the cathode before the state of oscill - ation is reached for the actual operation one avoids for sure the disturbances created by what is often call-

ed the " sleepy state " of the magnetron or designated by similar names. At the primary side of the high- voltage transformer which when the magnetron is ready to become put on stream (i.e. then when it is hot) one has provided a number of taps for the regulation of the operating voltage, what renders possible to do such regulating with weakly charged coupling means, as namely one of the transformers, which is mounted in parallel with the primary side, needs only to transmit roughly half of the power necessary at the high- tension side. Other advantages of this arrangement of the circuit are the ones that cooling occurs more effectively as the various coils need only be of a smaller thickness and because the height of the construction and its weight are smaller.

In figures 1 till 3 have been drawn a typical embodiment of the invention, and in the drawings appear only these parts which have a bearing upon the oven of the kitchen stove .

Figure 1 shows the oven with waveguide and with air- cooled magnetron, how a person would see it who looks at the oven from the rear.

Figure 2 is a section through the equipment done along line A-B in figure 1.

Figure 3 shows schematically the bars of the grill in this type of construction of the equipment.

1 designates the wall portions of the oven of the kitchen stove. The door 2 closes the opening of the oven. The (re)heater 3 of the grill is attached to insulatrs 4. In order not to render the drawings too

nobulous th -o have been omitted all ' ose parts which are required for the ordinary operation of the oven, either full- blast or with moderate heat. The magnetron 5 has been drawn with its magnets and its cooling sheaths. The connecting tubing 6 protrudes in a manner known as such by roughly λ/4 into the wave-guide 7. The slot 8 is located in the center of the rear wall portion with protruding profile, at the correct position of the waveguide. Opposite the slot 8 one has placed in parallel to the rear wall of the oven the reflector plate 9 which is more or less symmetric in shape and the edges of which are bent- around. The blower 10 blows cooling air between and among the cooling sheets of the magnetron. A portion of the cooling air is pumped across openings 11 in the wave-guide 7 from where it escapes by passing through the slot 8 and an opening machined into the wall portion of the oven, entraining this way the vapors and grease fumes. The path of motion of the air has been indicated by arrows. The supporting grooves 12 carry the grill 13 which has been drawn in broken lines. One recognizes from figure 3 how the bars of the grill are arranged.

C L A I M S

A kitchen stove of the type and the dimensions commonly employed with heating plates and oven which has equipment for grilling, which kitchen stove is CHARACTERIZED by the following features which may occur individually or in any combination:

1. In the space located below the stove, between

and among the feet of the kitchen stove are placed a generator for microwaves and its current-supplying device from which microwave generator the energy in the shape of microwaves is transmitted to the oven under use of a waveguide which is placed along a lateral wall portion, across at least one slot(s).

2. The wave guide is located against the rear wall portion, and a slot is located more or less in the center of this wall.

3. Before the lateral wall portion which has the one or the several connecting slot(s) is placed a reflector plate the dimensions of which are smaller than the ones of the lateral wall portion, which setup is brought about like this that between the reflector plate and the adjacent wall and annular (open-) space becomes created.

4. For purposes of adaptation one may let vary the distance between the reflector plate and the lateral wall portion with the slot(s) and in order to affect the distribution of the field inside the oven one may let vary the widths of the annularly shaped space.

5. The central zone of the reflector plate is receding, and the edges of this plate are bent(around).

6. The lateral wll portion close to the slot or slots protrudes outwardly in the shape of a cuvette,

7. One has installed a cooling with a blower for the electronic generator tube, and a portion of the cooling air is pumped into the wave guide.

8. The circuits for the heating elements which are located inside the oven and the circuit of the motor

of the blow pass through a common circuit- breaker.

9. The bars of the grill are placed like this that the grill is permeable for the field in the main direction of the polarization existing in the oven,

10. The grill is supported by the lateral wall portions from which it is insulated.

11. In the case where one has provided a starter coupling and a service coupling for the circuit portion of an electronic emitter and especially a magnetron emitter in which the high- voltage transformer for the anode voltage of the electronic tube is subdivided into two individual transformers the secondary windings of which are connected in series, one of the high- voltage transformers, when the electronic tube is ready to be put on stream, is permanently connected with the primary side to the circuit (mains) voltage and its secondary voltage has such a value that to the cathode a small preliminary charge is supplied for which the oscillatory state has not yet been reached, and the primary winding of the second transformer becomes connected when fully operating to the network (mains) voltage.

12. At the primary side of the high- tension transformer which at the moment of starting is the only one is under tension one has provided a number of (current-) taps for the adjusting of the secondary operating voltages.

For the
Company named MIWAG MIKROWELLEN AG p.p. Simonnot, Rinuy & Blundell.

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FILED
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ALEXANDER L. STEVAS
CLERK

No. - .

In the

Supreme Court of the United States.

OCTOBER TERM, 1983.

RAYTHEON COMPANY,
PETITIONER,

v.

ROPER CORPORATION,
RESPONDENT.

Appendix B.

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PETITION FOR WRIT OF CERTIORARI TO THE
UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

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UNITED STATES DISTRICT COURT

DISTRICT OF MASSACHUSETTS

RAYTHEON COMPANY,

Plaintiff

V. Civil Action

80-2035-MA

ROPER CORPORATION,

Defendant

OPINION

Mazzone, D.J.

January 20, 1983

STATEMENT OF THE CASE

This is a patent declaratory action brought by Raytheon Company (Raytheon)

against Roper Corporation (Roper). Raytheon seeks a declaratory judgment that Roper's U.S. Patent 4,028,520 ('520 patent) entitled "Air Flow System for Common Cavity Microwave Oven" is invalid. 1/ The inventor is Sumner H. Torrey. Roper has denied that its patent is invalid and has counterclaimed for patent infringement. Jurisdiction is properly invoked under 20 (sic) U.S.C. §§1338(a), 2201 and 2202. Venue is proper under 28 U.S.C. §1400.

Specifically, Raytheon claims that the '520 patent is invalid because (1) it lacks utility, a requirement of 35

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1. A second Roper patent, U.S. 4,028,519 was originally involved in this suit, but has been withdrawn by the parties.

U.S.C. §101; (2) it is obvious, 35 U.S.C. §103; and (3) it lacks an enabling disclosure and fails to particularly specify the invention, as required by 35 U.S.C. §112. Raytheon also seeks attorneys' fees under 35 U.S.C. §285. Roper answers that its '520 patent is valid and further counterclaims that Raytheon has deliberately and willfully infringed its '520 patent.

The case was tried to the Court without jury. The order of trial was reversed by the Court and Roper, the patentee, presented its case first on the issues of validity and infringement. The issue of damages was reserved for a later hearing, if necessary. The record consists of the trial testimony, various depositions and numerous exhibits. Pursuant to Fed.R.Civ.P. 52(a), I make

the following findings of fact and conclusions of law. [2/]

I. FINDINGS OF FACT

Background of the Case

The subject matter of this suit is a "common cavity" oven with a pyrolytic self-cleaning feature. This common cavity oven has the capacity, in the same oven structure, to perform conventional thermal cooking (i.e., baking, broiling), microwave cooking, and combination

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2. My conclusion that the patent is non-operative and, therefore, invalid, is dispositive of this case. However, given the efforts of counsel in presenting this extensive record and mindful that a final resolution of the case is desirable, I have set out my findings and conclusions in a more extended fashion to allow an appellate court to examine all of the issues raised by the pleadings.

thermal and microwave cooking. The oven also self-cleans by heating the walls to about 900°F. to break down the soil baked on the walls, so as to pyrolize it.

In sum, the oven is designed to perform every cooking method and self-clean as well. It provides conventional thermal cooking together with the advantages of rapid and efficient microwave cooking. At the same time, it provides for crisping and browning which is not always possible with microwave cooking alone. Pyrolytic self-cleaning, the third feature, is practically effort free to the consumer, as contrasted with continuous cleaning which requires that the decomposed material on the oven walls be wiped off and removed manually by the consumer.

These three functions are not totally compatible. Thermal cooking

requires only minimal amounts of air and ventilation has usually been accomplished by providing a gap or opening in the oven door to let air enter and flow upwardly through the oven and out a vent located at the top of the oven by natural convection.

In a microwave oven, microwave radiation provides the energy that cooks the food. The microwave radiation is absorbed by the food and cooks it from the inside rather than the outside, as is the case in conventional thermal cooking. The radiation is supplied by a microwave feed unit. The unit includes a magnetron which generates the radiation and an antenna that transmits it to the oven. The radiation travels from the magnetron to the antennna through a hollow metal tube called a waveguide. The magnetron has fins projecting from its housing to

help dissipate heat. A fan or blower is provided to move air through the magnetron fins and the power supply to cool them from the substantial amount of heat generated in the process.

Microwave cooking produces more moisture because of its speed and process. This moisture must be removed from the oven, and in the conventional countertop or separate microwave oven, the moisture is removed by a blower or fan which is located in the microwave component area and blows the vapors and gases out a vent in the top of the oven. Microwave cooking also requires maximum sealing of the oven cavity to prevent escape of microwave energy through gaps in the oven structure.

The third feature, the self-cleaning feature, is an additional complicating factor. Self-cleaning is done without

oxygen, but some air is needed to flush out the smoke and volatile products of the pyrolytic process. This smoke will flow out any available opening including backwards through the opening in the waveguide. If excess air enters, with the extremely high temperature and possibly volatile gases, especially if the oven is very dirty, combustion may occur in the oven cavity. This combustion is known as autoignition, and produces sudden pressure within the oven which also seeks release through any opening, including the waveguide. The products of this combustion could enter the waveguide and the microwave unit components. If the autoignition were fueled by even greater amounts of excess air, fire inside the cavity could result or even an explosion sufficient to force open the oven door. This case involves

the combination of these cooking cleaning modes. Self-cleaning called for the microwave feed system to be sealed to prevent possible fouling. Sealing the system meant inadequate ventilation for microwave cooking. The other possibility was to provide forced air for moisture-free microwave cooking, and either giving up self-cleaning or risking fouling by autoignition. This patent claims to have resolved this dilemma.

The Prior Art and Its Teachings

The relevant art encompassed the fields of microwave ovens, combination microwave and thermal ovens, and pyrolytic self-cleaning ovens.

Self-cleaning, common cavity ovens were first marketed by General Electric in the mid-1960's. Its first model was called the "Versatronic." That model was followed by the "Superstove" model which

came on the market in the mid-1970's. In the early 1970's, Litton Industries also introduced a self-cleaning common cavity oven. Both of these ovens sealed off the microwave system to prevent fouling and, therefore, did not have forced air. Steam and moisture accumulated in the cavity during microwave cooking, presenting discomfort and perhaps a mild danger to the user when the oven door was opened after cooking was completed, especially after cooking a high-moisture product. Both General Electric and Litton felt this discomfort or danger was sufficiently worrisome to require a warning to their customers in their product manuals.

Other teachings in microwave cooking included the Boehm patent, No. 3,440,386, which taught that convected air through gaps in the door was not sufficient to

remove steam and adequately ventilate the oven. Boehm taught that the microwave mode could be ventilated properly by forcing air into the cavity with fans. This required that the microwave feed system be open and, therefore, subject to fouling. Boehm also taught that the magnetron, the tube which generates the microwave, becomes hot during microwave cooking and must be cooled. Cooling is accomplished by using a blower directing air over the magnetron. This same air can be directed into the oven cavity to ventilate it. This same arrangement is present in French, (sic) Patent No. 1,249,130. Both the Boehm and French patents required that the end of the microwave feed system be open to the oven cavity and, therefore, vulnerable to contamination by backflow. And both patents point out that contamination is

undesirable because it adversely affects the oven's performance. Neither Boehm nor French included the pyrolytic self-cleaning feature.

Pyrolytic self-cleaning creates smoke and other by-products, some of which can be carbon. The teachings in this area introduced air to the oven cavity by convection during self-cleaning. Hurko, Patent No. 3,121,158 pointed out the undesirability of the presence of carbon especially when autoignition occurs. While autoignition does not always occur, Hurko taught the criticality of limiting the amount of air allowed to enter the cavity. The Lewis patent, Patent No. 3,348,023, created a gap in the door gasket to provide an air inlet to ventilate the cavity. It was also known from Long, Patent No. 2,961,520, that microwave energy

could be supplied to the microwave oven cavity from the bottom of the cavity.

The prior art also included variations on the foregoing which will not be set out here. Generally, the prior art can be summarized as follows:

(1) Microwave ovens utilized forced air from a blower which cooled the magnetron and flowed into the oven cavity to ventilate it.

(2) Pyrolytic self-cleaning allowed naturally convected air to enter the oven capacity during self-cleaning through a gap or some other aperture, usually in the door structure.

(3) Microwave energy was supplied from below the oven cavity.

(4) To prevent contamination of the microwave feed system by autoignition and backflow, the end of the system was sealed.

The prior art did not teach any combination of microwave and conventional ovens which utilized forced air through the microwave system and had a pyrolytic self-cleaning feature. The prior art said the microwave energy source would be contaminated if placed below the oven cavity. Because sealing the microwave feed system to prevent contamination meant the cavity was not adequately ventilated, steaming and moisture was a marketing problem in the self-cleaning common cavity oven.

The problem was of different proportions to the concerned parties. To the home economist who was concerned with the marketing of the product, the problem of steaming was a critical one which called for customer warnings and engineering improvement. To the

engineer, the problem was less critical, if indeed, it existed at all.

A person of ordinary skill in this field was aware of the efforts to develop an effective, safe and commercially acceptable common cavity oven with pryolytic self-cleaning. Raytheon and Roper both employed people skilled in the art of designing ovens for cooking food in both microwave and thermal modes. Their staffs were comprised of graduate engineers with substantial background and experience in the design, development and marketing of ovens. Those people were all knowledgeable of the prior art, were aware of the incompatibilities of the modes, and were continually engaged in research and development of self-cleaning common cavity ovens.

Development of the Roper Oven

Roper is a designer and manufacturer of ovens. In 1973, at the urging of Sears Roebuck and Company, it began to work on a common cavity, self-cleaning oven. Roper was seeking a product which would be competitive with, if not better than, the General Electric common cavity ovens. At that time, General Electric had the major share of the market.

Sumner H. Torrey, was assigned to the project. Research was conducted at Roper's plant in Kankakee, Illinois, and at its appliance research center at Purdue University in Lafayette, Indiana, called the Purdue Research Center.

Roper conducted tests of all available ovens then on the market and noted the deficiencies in performance, such as energy loss, uneven cooking, and steaming. Torrey had a staff of 3 or 4

engineers who worked on the project with him. One of those engineers was Buddy J. Austin. Austin worked closely with Torrey and worked especially on the development of the antennna and circuitry. In February, 1976, Austin was a co-applicant on a patent application for the Roper common cavity antenna, No. 4,028,021.

In addition to its own internal research, Roper contracted with Beverly D. Kumpfer, of American Microwave, Inc. as a consultant. Kumpfer made many helpful suggestions to Torrey and delivered a prototype oven to Roper to continue the design research. Their combined efforts were directed to a bottom location, as well as improved cavity ventilation. They were also concerned with microwave leakage and worked on a better door seal as well as a

microwave "choke," a construction of the door which further inhibited leakage. Chokes were utilized on some microwave ovens examined by Roper. Also, some models used a small gap in the door seal to admit air for ventilation purposes. Eventually, Roper settled on a continuous door gasket without the gap that allowed convective air into the cavity. This design meant the microwave feed system was the only intended entry through which air could enter the oven cavity.

Torrey proceeded to design a further prototype, using a Roper self-cleaning oven. With Kumpfer's assistance, he located the microwave system in the bottom, and used a blower to cool the magnetron and force air into the cavity during the microwave mode. He tested the model in the self-cleaning mode, using 6 ounces of butter, and, to his surprise,

he found no problems; that is, he noticed no visible contamination of the microwave feed system and concluded that there was no backflow. There was also adequate ventilation. Torrey believed he had now reconciled all the features.

Air to remove microwave cooking moisture was provided by forcing air through the microwave system into the cavity. The door seal was gap-free to prevent the microwave energy escape which produced less efficient and uneven cooking results. By turning off the blower and allowing naturally convected air to enter through the same microwave system entry now located on the bottom of the structure, the venting requirements of thermal cooking were satisfied. At the same time, this air flow system appeared to prevent the backflow into the

microwave feed system which would result in fouling the system.

In addition to reconciling these two modes, Torrey added the third mode, pyrolytic self-cleaning. This mode required the control of air intake to prevent autoignition. Torrey claimed the entry of air was limited by the openings in the waveguide and the naturally convected air allowed to enter and flow through the oven provided the air required for thermal cooking, prohibited backflow, and protected against autoignition. Torrey claimed the flow of air for microwave cooking was within the range of 3 to 8 c.f.m. when the blower was on and the flow of convected air for baking and self-cleaning was within the range of 0.5 to 2 c.f.m.

In sum, Roper claimed this invention did not require the choice of pyrolytic

self-cleaning at the expense of forced ventilation through the microwave feed system. This invention provided forced ventilation for microwave cooking and a pyrolytic common cavity oven which could be properly and efficiently ventilated if the microwave feed system was located below the oven cavity and an air path was provided for naturally convected air up into the cavity for sufficient venting during thermal cooking and self-cleaning.

In January, 1976, the Roper oven was demonstrated for the first time at a trade show in Dallas, Texas. The industry was now aware that Roper had entered the field with its own product. In February, 1976, Roper applied for a patent for its "Air Flow System For Common Cavity Oven."

In the summer of 1976, Roper's oven was marketed nationally under its own

name and by Sears, Roebuck & Company under its Kenmore label. Since then, about 24,000 of these ovens have been sold, 70% under the Kenmore label. There have been no complaints with the performance of the Roper oven insofar as steaming or contamination of the microwave feed system is concerned. The Roper self-cleaning, common cavity oven was and is a successful product.

Development of the Raytheon Oven

Raytheon began to work on a common cavity oven in early 1975, later than Roper. Its ovens were designed by its staffs located at Caloric and Amana, two of its subsidiaries, as well as at its own New Product Center in Waltham, Massachusetts. Raytheon was also seeking a product to be competitive with General Electric's oven.

Its initial prototype, developed in December, 1975, had a fan in the rear wall which also acted as a microwave antenna. The microwave power supply and magnetron were sealed below the oven and a waveguide was run up the back of the oven to the fan antenna. The microwave pattern provided by this system proved unsatisfactory for cooking. Raytheon also insisted that it maintain a high power wattage of 600° to 700° F. (sic) in its microwave cooking mode. There was also a serious steaming problem during the microwave cooking mode which continued to February, 1976, when the prototype was sent to Caloric and Amana for further development.

In late January, 1976, Buddy J. Austin, one of the engineers on Torrey's staff at Roper, left Roper and went to work for Raytheon at its Amana

subsidiary. Thereafter, he worked with other Raytheon engineers on the development of Raytheon's self-cleaning common cavity oven. Austin was able to identify most of the problems in Raytheon's development program. He had not only worked closely with Torrey, he had also worked on the microwave power supply and its construction, co-signing the aforementioned patent application. There followed several other developments at Raytheon, with which Austin had some familiarity. 3/ In April, 1976, Raytheon began to force air through its microwave feed system and the steaming problem was solved in microwave cooking. Then, also

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3. There is no suggestion that Austin acted improperly or unethically in moving to Raytheon's employ and assisting in the development of Raytheon's oven. Rather, it goes to show familiarity with the Roper-Torrey developments and, if credited, is evidence of copying.

in April, 1976, the Raytheon prototype oven was tipped over on its back during an experiment, thereby placing the microwave antenna in the bottom of the oven. This resulted in a satisfactory microwave pattern and the cooking results were satisfactory. Raytheon's oven was now ready for marketing.

Raytheon's oven had started with a microwave feed system running up the rear of the oven, and with no forced air into the oven cavity through the microwave mode. After an additional adjustment which simply increased the amount of air needed to vent the oven, Raytheon now had the same arrangement as contained in the Roper oven. The Raytheon oven now had a bottom microwave feed system, forced air through the microwave system to vent the oven, just as in the Roper oven. Similarly, there was no steaming problem

and there was no fouling. The Raytheon oven was both structurally and operationally similar to the Roper oven.

The differences remaining did not materially affect the operation of the oven. The air inlet for Raytheon's oven was in the bottom front; while the Roper air inlet was in the bottom rear. The Raytheon oven door seal retained the "gap," while Roper's oven had a continuous door seal. This difference is not significant. Most of the air for the ventilation comes from the microwave system, only slight amounts being admitted through the Raytheon gap. This air does not affect the operation of the Raytheon oven in any material way. Even the Roper door seal is not a perfect seal and admits some air. A third difference is that Raytheon has more than one constriction in its air passage system.

However, it is the concept that limiting air through the system that matters. The Roper claims do not teach only one constriction. Similarly, Raytheon's insistence on its high power wattage of 600° - 700° F. (sic) would not materially affect the operation of the system. In every material respect, the Raytheon oven is a copy of the Roper oven.

Proceedings in the Patent Office

The application for patent was filed on February 26, 1976. Roper was the assignee. The references cited referred to microwave ovens alone (Long - No. 2,860,026; Long - No. 2,961,520; Fukuda - No. 3,470,942; and Fitzmayer - No. 3,626,135), conventional thermal ovens (Eff - No. 3,367,316), common cavity ovens without self-cleaning (Fitzmayer - No. 3,172,987), or self-cleaning with microwave (Maitenaz -

No. 3,962,561). Roper also cited the Boehm and French patents. There was no mention of the General Electric or Litton common cavity, self-cleaning ovens.

A test of the Roper oven was conducted by Underwriters Laboratories on July 2, 1976. Underwriters Laboratories is an independent, non-profit organization testing for public safety. The test consisted of placing 8 ounces of beef suet into the oven and operating it for self-cleaning. There was smoke evolution from the microwave assembly openings. Vapors within the microwave asembly ignited once with a flash, but there was no continuous burning. The results of this test were not provided to the Patent Office.

In summary, it was the object of the invention to provide a common cavity oven for every cooking mode as well as

expelling decomposition products during the self-cleaning mode. It was a further object of the invention to provide a ventilation system which resisted autoignition or explosion, and backflow, and, therefore, contamination of the power supply housing and waveguide.

Claims 1, 2, 5 and 7 claim to prevent autoiginition. Claims 1, 3 and 4 claim to prevent backflow. Claim 6 claims to preclude the escape of microwave energy.

The claims were allowed by the patent exminer without change or comment. The patent in suit was issued on June 7, 1977.

Miscellaneous Findings

Both parties conducted extensive tests in preparation for this case. [4/] Torrey compared and tested the Caloric oven against the Roper oven. His tests showed there was no smoke during autoignition and, therefore, no backflow in both ovens. Roper also obtained three Roper waveguides which had been in use in customers' homes for over six years. Those waveguides were inspected and showed no visible fouling or contamination.

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4. The test will not be described here, but the Roper tests and standards are recorded in Exhibits #73, #74 and #75. The Raytheon tests are recorded in Exhibits #271, #272 and #273. As can been seen from those exhibits, many of the tests were similar, although the observations were not.

Another Roper trial expert, Norman Kirschke, inspected both the Roper waveguides as well as some Caloric waveguides and concluded neither were fouled or contaminated. While all backflow may not be entirely eliminated, Roper says the practical effect of these tests and and the proof of its patent's validity, is that there is no significant backflow and there is no fouling or contamination.

Raytheon, in turn, submitted the Roper oven to various tests arranged and observed by Bohdan Hurko, a long-time employee of General Electric and, Raytheon's expert witness at trial. Hurko was the inventor of the Hurko patent, U.S. Patent No. 3,121,158, and has over 50 patents issued. He has had extensive experience with self-cleaning ovens.

The tests arranged by Hurko included a duplication of the single Torrey test as well as other tests generally used by Underwriters Laboratories. While these tests were not typical of normal use, they were all within the capabilities of the oven and, therefore, were a fair test for the presence of backflow and waveguide fouling. They are also tests required by Underwriters Laboratories before they certify the product for home use. Some of the tests were also run on the Caloric oven which is the subject of the infringement charge by Roper. In every test of the Roper oven, backflow in the form of smoke was clearly observed. In certain of the tests, the smoke was very noticeable. Where smoke was not readily discernible, evidence of backflow was provided by the movement of tissue paper strips placed over the waveguide

opening. The temperature charts supported the instances of autoignition. An examination of the waveguide after these tests revealed no deposits, and, therefore, no fouling.

Hurko maintained that even if smoke were not observed, there was still backflow in small amounts in the system which was dispersed inside the waveguide. Moreover, since the pressure of autoignition ranged up to 10 pounds p.s.i. and the convected air was limited to 0.5 to 2 c.f.m., Hurko stated backflow can occur at any time when the autoignition pressure is more than one pound p.s.i. In any event, Hurko says, despite the presence of backflow, it is simply not a problem.

Further, another Raytheon expert, Bernard Weiss, also inspected the Roper oven. It was his opinion that the Roper

oven does not prevent backflow into the waveguide and fouling. However, while this backflow might absorb energy, it has no effect on the operation and it burned off when the microwave mode is used. Weiss also inspected the three Roper waveguides and claimed he detected a film or light layer of film on them, but attached no significance to it because backflow presented no problems. It is not surprising that the waveguide showed no visible fouling. First, autoignition occurs rarely, about 6 times a year, and secondly, it is accompanied by short puffs of smoke, lasting only a second or two.

Thus, the experts on both sides are in sharp conflict. Raytheon's experts claim there is backflow and still no fouling in both Caloric and Roper ovens. Roper's experts claim there is no

backflow in both, Roper and Caloric ovens) and, therefore, there is no fouling.

I find that the Roper oven does not prevent backflow of air into the waveguide regardless of the temperature achieved within the oven cavity. It is clear to me that the gentle pressure of natural convection cannot and does not resist the sudden and sometime intense pressure of occasional autoignition. The essence of this invention is the prevention of backflow. It does not do that. Finally, it is also clear to me that even with the backflow, there is no

discernible or significant fouling of the waveguide. 5/

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5. The parties in this case engaged in protracted and expensive pre-trial discovery, assembled 320 exhibits, including numerous video tapes, took numerous depositions, engaged several expert witnesses on each side, and conducted an 8 day jury-waived trial with 3-4 lawyers in attendance daily for each party. Yet, the most convincing evidence was the test, which both parties conducted over 2 years after the suit was filed and at approximately the same time in October to December, 1982. Those tests persuaded me that the Roper oven did not prevent backflow, and that even if it did not prevent backflow, the waveguide was still not fouled. Those two claims - prevention of backflow and, therefore, no waveguide fouling - are the very essence of Roper's patent.

Perhaps more pre-trial discourse between the parties, with independently conducted tests, would have resolved the issues, or at least, narrowed the issues to the point where the expense and effort of all of the participants would have been minimized.

II. CONCLUSIONS OF LAW

The two issues in this case are whether the patent in suit is valid and whether it was infringed. 6/ Before turning to the issues, several preliminary conclusions are appropriate.

The invention date is February 26, 1976, the date on which the application was filed. Accordingly, the prior art must be viewed from the point in time just prior to that date. 35 U.S.C. §103; Monroe Auto Equipment Co. v. Heckethorn Mfg. & Supply Co., 332 F.2d 406, 412 (6th Cir.), cert. denied, 379 U.S. 888 (1964).

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6. Many issues in patent litigation involve mixed questions of fact and law. To the extent the following incorporates factual material, it should be regarded as a continuation of the findings set forth above.

Once granted a patent is presumed valid. The presumption may be rebutted, and the party challenging the patent's validity bears the burden of proving that patent is invalid. 35 U.S.C. §282; Shanklin Corp. v. Springfield Photo Mount Co., 521 F.2d 609 (1st Cir. 1975).

Validity

Raytheon challenges the validity of the patent in suit on three grounds: (1) obviousness, 35 U.S.C. §103; (2) lacking utility, 35 U.S.C. §101; and (3) failing to contain an enabling disclosure and failing to point out and distinctly claim the subject matter of the invention, 35 U.S.C. §112.

Patentability is dependent on three essential elements, namely, novelty, utility and non-obviousness, articulated and defined in 35 U.S.C. §§101, 102 and 103. These elements constitute separate

tests of patentability, each of which must be met in order for a patent to be valid. Graham v. John Deere Co., 383 U.S. 1 (1966); United States v. Adams, 383 U.S. 39, 48 (1966). Accordingly, even though the test of non-obviousness under §103 may be met, the patent still may not issue if the product does not satisfy the additional tests of utility and novelty.

(1) Obviousness

35 U.S.C. §103 provides that an invention is not patentable if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art. The question of obviousness is to be determined

against the background of several basic factual inquiries:

> Under §103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved.

Graham v. John Deere Co., 383 U.S. at 17.

Applying this three-pronged test to the facts of this case, I conclude that the prior art either sealed the end of the waveguide to prevent backflow or it eliminated the self-cleaning mode from the oven. The General Electric and the Litton ovens that were on the market did not have forced air venting through the waveguide during the microwave cooking mode, and as a result those ovens had a moisture problem during microwave cooking. Rather, those ovens sealed the oven cavity end of their waveguides to

prevent the backflow of vapors from the oven cavity.

More specifically, the Boehm patent forced air through the waveguide, but did not self-clean. The Long patent dealt with supplying microwave energy from the bottom, but did not self-clean. The Eff patent and the Maitenaz patent dealt only with limiting air in self-cleaning ovens. The Fitzmayer patent dealt with a common cavity oven, but sealed off the waveguide to prevent fouling. All of these references were a fair summary of the prior art at the time of the Roper application. All of these references were known by those persons of ordinary skill in the art. They were unable to devise a common cavity oven with proper ventilation with the pyrolytic self-cleaning feature. The fact that they were unable to do so is evidence of non-

obviousness. Timely Products Corp. v. Arrow (sic), 523 F.2d 288, 294 (2d Cir. 1975). The fact that Torrey, the inventor, was not able to explain his invention and was surprised by the results does not affect the inventiveness of his product. Reese v. Elhart Welding & Boiler Works, 447 F.2d 517, 525 (7th Cir. 1971). Moreover, unexpected results can evidence non-obviousness. International Telephone & Telegraph Corp. v. Raychem Corp., 538 F.2d 453, 457 (1st Cir. 1976).

The Roper effort differed from the prior art in three respects. It put the waveguide on the bottom. It used part of the cooling air to ventilate the cavity with a blower during microwave cooking. And, when not using forced ventilation, i.e., during the self-cleaning and thermal cooking modes, naturally

convected air was drawn through the system into the cavity in just the right amount to resist backflow.

None of the prior art taught a combination of these features.

The burden of proof is on Raytheon to show obviousness by a standard of clear and convincing evidence. E.I. DuPont de Nemours v. Berkly & Co., Inc., 620 F.2d 1247, 1261 (8th Cir. 1980). Raytheon has not met that burden. The invention is not obvious under 35 U.S.C. §103.

(2) Lack of Utility

Raytheon claims the patent is invalid because it fails to accomplish two stated objectives. Raytheon says the patent is ineffective because it fails to eliminate the possibility of explosion during the self-cleaning mode and it fails to eliminate backflow into the

waveguide. This entire claim is based on various tests run by Raytheon which show that the Roper oven does not prevent backflow and even in those tests which showed backflow, there was still no waveguide fouling.

Roper appears to agree that the prevention of backflow and fouling is the key to the invention and submitted tests to show the patent was effective to accomplish those objectives. Roper also secured waveguides which had been in use for the 6 years and none showed any contamination. There was evidence that there have never been any complaints of explosion or fouling in the over six years that the Roper oven has been on the market.

The question, then, is whether the system described in the patent is effective to accomplish the objectives

claimed by it. On the record before me, I must conclude that it is not. The tests run by Raytheon show that the Roper oven does not prevent backflow, as it claims it does. At the same time, even with the backflow, there is no waveguide fouling. Hurko testified unequivocably that backflow is not a problem even though it exists in the Roper oven. His conclusions are fully supported by his tests which were conducted according to Underwriters Laboratories' standards.

According to Roper, there is no waveguide fouling because there is no backflow. The evidence, which I accept, is that there is backflow, but there is also no waveguide fouling. The conclusion is inescapable, in my judgment. The Roper oven does not substantially accomplish the results claimed for it in the specifications.

The patent claims a result which it cannot obtain. 35 U.S.C. §101 states:

> Whoever invents or discovers any new and useful process machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor....(emphasis supplied)

The term "useful" means that the invention must attain the result claimed by the inventor in his patent. It must work and accomplish its objectives. O'Reilly v. Morse, 56 U.S. 62 (1853); H.C. Baxter Bros. v. Great Atlantic & Pacific Tea Company, 266 F. Supp. 601 (D.ME 1964).

Raytheon has sustained its burden of showing lack of utility by clear and convincing evidence. The patent is not useful and is, therefore, invalid. 35 U.S.C. §101.

(3) The Failure to Describe and Claim the Invention

35 U.S.C. §112 requires that a patent contain a description of how to use the invention to achieve the objects of the invention and the invention must perform the function claimed. General Electric Co. v. Wabash Appliance Corp., 304 U.S. 764 (1978). When an incorrect or questionable theory of operation is included in a patent claim, that claim is invalid. 35 U.S.C. §112; Graver Tank & Manufacturing Co. v. Linde Air Products Co., 336 U.S. 271 (1949).

Raytheon claims that the Roper oven fails to achieve the objects of the invention, namely, elimination of autoignition or backflow. The invention fails, Raytheon says, to describe a device that achieves the uni-directional air flow to eliminate backflow. Raytheon

bases this challenge on its tests that show that there is backflow and autoignition. This is largely a restatement of the challenge to the utility of the Roper oven and need not be re-analyzed here. Accordingly, the patent does not disclose the means of attaining the objects of the invention. O'Reilly v. Morse supra, at 119; Mitchell v. Tilghman, 86 U.S. 287, 392 (1873). Raytheon has sustained its burden of showing the patent is invalid under 35 U.S.C. §112.

Infringement

Having concluded that the patent is invalid for lack of utility and overclaiming, a ruling on infringement is not necessary. See 7 Deller's Walker on Patents, §588 at 425 (an invalid patent cannot be infringed). However, so that

this case can be resolved finally, a ruling on infringement is desirable. United Shoe Machinery Corporation v. Industrial Shoe Machinery Corporation, 335 F.2d 577, 578 (1st Cir. 1964), cert. denied, 329 U.S. 990, reh. denied, 380 U.S. 927 (1965).

Infringement must be proved by a preponderance of the evidence. General Electric Co. v. United States, 572 F.2d 745 (Ct. Cl. 1978). To prove infringement, Roper must show that every element set forth in at least one claim be present in Raytheon's oven and that the Raytheon oven must do substantially the same work in substantially the same device. Westinghouse Air Brake Co. v. Boyden Power Brake Co., 170 U.S. 537, 538 (1898); Graver Tank & Manufacturing Co. v. Linde Air Products Co., 339 U.S. 605 (1950).

Raytheon claims its ovens do not infringe because its oven fails to accomplish the same result in the same way as the claimed device. Specifically, Raytheon's door contains a gap through which air flow is designed to enter. Roper argues that the gap in Raytheon's door is so small as to be of insignificant effect on the entry of air. Roper also claims that no commercial oven door completely seals against the passage of air.

Raytheon also says its oven does not infringe for two additional reasons. Its oven does not prevent backflow with the waveguide during autoignition and that its oven has more than one constriction of the airflow passageway comprising the airflow system.

This issue boils down to the presence of the "usual gap" in Raytheon's

door and the presence of some backflow. If the patent were valid, it would be so because there was sufficient naturally convected air flow through the waveguide to prevent significant backflow.

First, the evidence is clear that the "usual gap" in the Raytheon door does not materially affect the entry of air. Most of the air admitted and which is naturally convected through the cavity comes through the waveguide. The "usual gap," therefore, is not a sufficient alteration. St. Regis Paper Company v. Winchester Carton Corporation, 410 F.Supp. 1304, 1308-09 (D. Mass. 1975) (infringement charge cannot be avoided where a competitior, by substitution or addition, accepts a somewhat less desirable result while acting within the concept of the invention).

A finding of infringement requires that there be an identity of structure, of mode of operation and of results accomplished between the claimed invention and the accused product. Graver Tank & Manufacturing Co. v. Linde Air Products Co., supra, 339 U.S. at 608-609. A change in form or a change in the position of one component is not sufficient to avoid infringement. The functioning of the air flow system taught in the Torrey claims is embraced by the Raytheon oven, and even though it may vary somewhat, it does not avoid infringement. The substance of Torrey's claim is adopted by the Raytheon oven and infringement can still be had under the doctrine of equivalents. Graver Tank & Manufacturing Co. v. Linde Air Products Co., supra, 339 U.S. at 609. See

generally 7 Deller's Walker on Patents §546.

In sum, my review of this record persuades me that if the Roper patent were valid, Raytheon's oven would infringe. It is operationally similar. It is structurally similar. The evidence shows that the Raytheon oven development began with a toatally different structure and eventually ended up with an oven which in every essential respect, is a copy of the Roper oven, as shown in the diagram on page 29.

Attorney's Fees

35 U.S.C. §285 provides that attorneys' fees may be awarded to the prevailing party in "exceptional cases." I do not find this to be an exceptional case. I do not find that Roper has acted in bad faith or that attorneys' fees are

appropriate or necessary to prevent injustice. See generally 8 Deller's Walker on Patents, §760. 7/

Conclusion

The patent in suit is invalid because of lack of utility and failure to particularly claim the invention. 35 U.S.C. §§103, 112. The plaintiff is entitled to a declaratory judgment that United States Patent No. 4,028,520 is invalid and unforceable.

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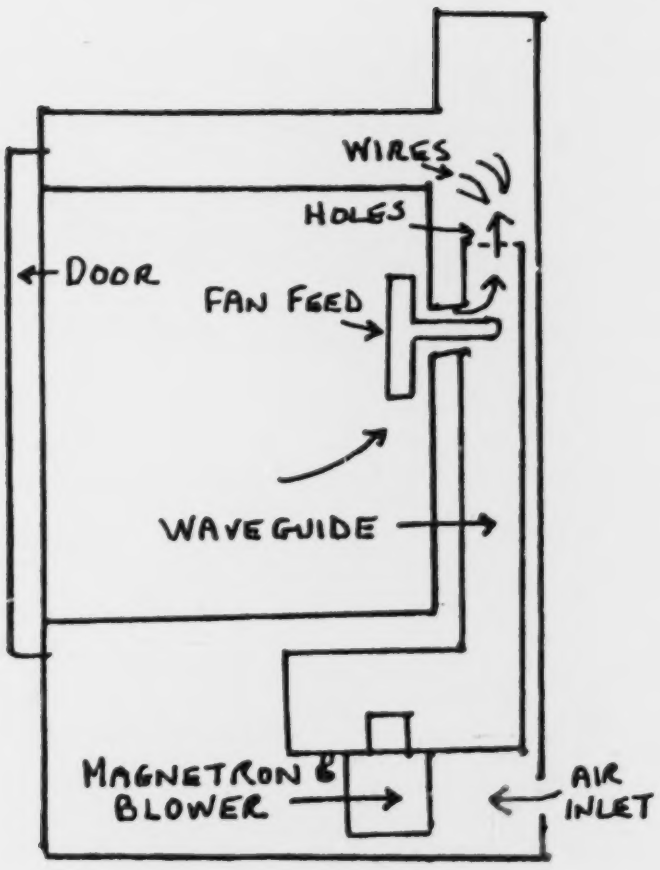
7. I am aware of my earlier note that more of a pre-trial effort by the parties in testing this oven may have persuaded them that a trial and the accompanying expense were not warranted. However, I cannot attribute the responsibility for that to either side.

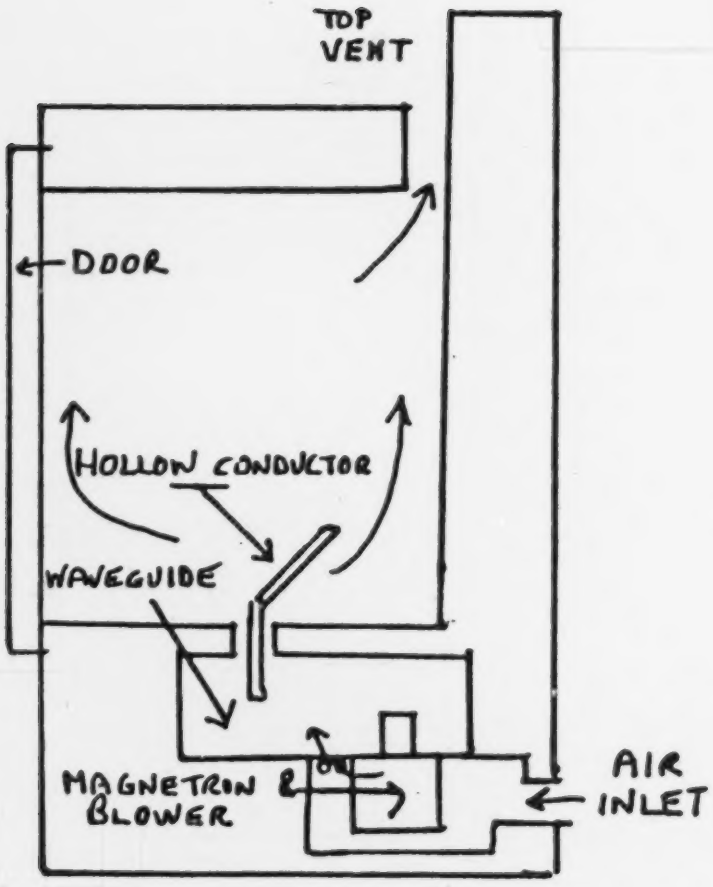
SO ORDERED.

/s/ A. David Mazzone

United States District Judge



RAYTHEON'S
1975 PROTOTYPE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WAVEGUIDE
MAGNETRON &
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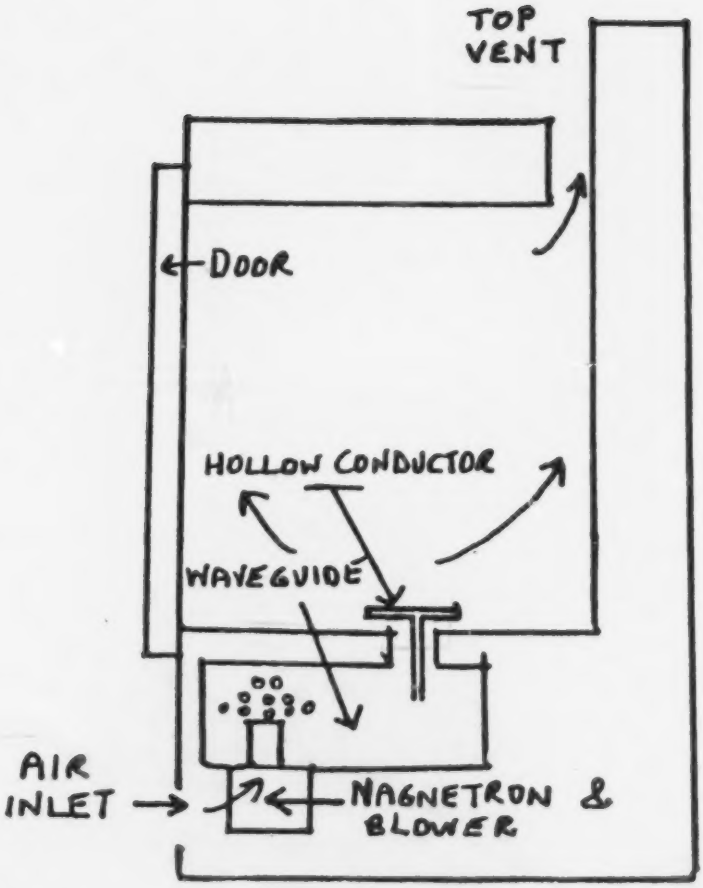
INLET

ROPER'S OVEN



RAYTHEON'S OVEN

Copy of '520 patent appended to district court opinion, is omitted; see App. A1.

United States Court of Appeals
for the Federal Circuit

RAYTHEON COMPANY,	)	Appeal
	)	Nos.
	)	83-851
Appellee/Cross Appellant,	)	83-853
	)	
v.	)	
	)	
ROPER CORPORATION,	)	
	)	
Appellant/Cross Appellee.	)	

DECIDED: December 30, 1983

Before MARKEY, Chief Judge, DAVIS, Circuit Judge, and KELLAM, Senior District Judge. */

MARKEY, Chief Judge.

Roper Corporation (Roper) appeals from a judgment of the United States District Court for the District of

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*/ The Honorable Richard B. Kellam, Senior District Judge, Eastern District of Virgina, sitting by designation.

Massachusetts declaring U.S. Patent No. 4,028,520 ('520 patent), issued to Sumner H. Torrey and assigned to Roper, invalid for lack of utility and because its disclosure is non-enabling. Raytheon Company (Raytheon) cross-appeals a holding of nonobviousness, a finding of infringement, and a refusal to award attorney fees. We reverse in part, affirm in part, and remand.

BACKGROUND

A. Prior Technology

The Roper patent is directed to a "common cavity" oven capable of conventional thermal cooking, microwave cooking, and pyrolytic self-cleaning (i.e., heating the walls to about 900°F. to break down soil baked thereon). Those three "modes" of operation (thermal

cooking, mircrowave cooking, and self-cleaning) are not totally compatible.

At the time of the Torrey invention, cooking in a thermal oven required minimal amounts of air. Ventilation of thermal oven cavities was accomplished through an opening in the oven door, air flowing by natural convection from the opening upwardly through the cavity and escaping via a vent at the top of the cavity.

Microwave cooking involved radiation supplied by a microwave feed unit. The feed unit included a magnetron generating radiation and an antenna transmitting the radiation to the oven cavity. The radiation travelled from the magnetron to the antenna through a hollow metal tube called a waveguide. The magnetron had projecting fins to help

dissipate heat. A fan or blower moved cooling air through the magnetron fins and power supply.

Microwave cooking produced more moisture than thermal cooking. To remove mositure vapors from the cavity of a conventional microwave oven, a blower or fan was employed to blow them out a vent at the cavity top. Microwave cooking also required maximum sealing of the cavity to prevent escape of microwave energy. Thus, the opening in the oven door of a thermal oven was not desirable in a microwave oven.

Inclusion of a self-cleaning mode further complicated the ventilation of an oven operable in the thermal and microwave modes. Though a limited air supply was needed to flush smoke and volatile products of self-cleaning, excess air caused combustion of those

products. That combustion, known as "autoignition", produced sudden pressure that sought release through any opening, including "backflow" through the waveguide. Although autoignition occurred only occasionally, backflow was thought to contaminate ("foul") the waveguide with burnt food particles cleaned from the cavity walls. Moreover, if autoignition were fueled by even greater amounts of excess air, as when forced air removed moisture produced in the microwave mode, fire or explosion could result.

Self-cleaning common cavity ovens were first marketed in the mid-1960's, but by 1973, the General Electric and Litton ovens on the market still had ventilation problems. To meet those problems, the ends of the waveguides in those ovens were sealed to

prevent fouling of the microwave feed unit by autoignition and backflow. As a result, moisture and steam developed in the microwave mode could not be removed by forcing air to the cavity through the waveguide. General Electric and Litton regarded this problem as serious enough to require customer warnings in their product manuals.

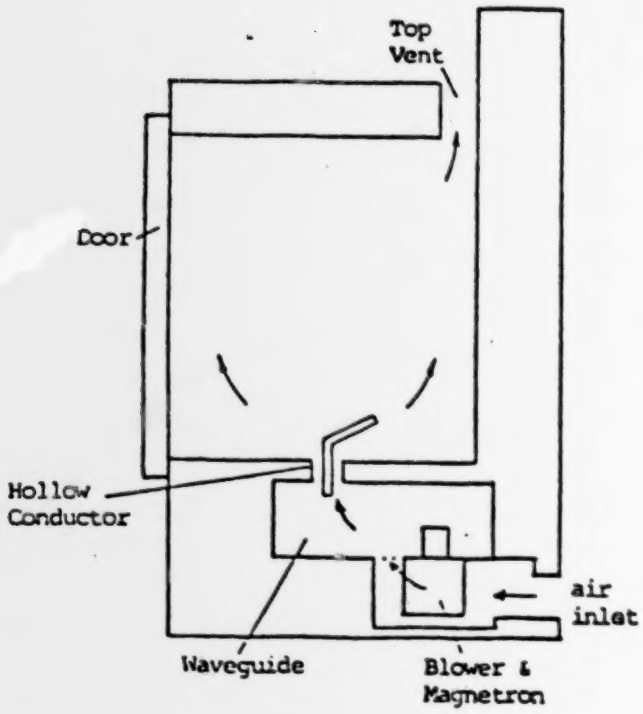
B. The Torrey Invention

In 1973, Roper began work on a self-cleaning common cavity oven. Under Torrey's supervision, Roper developed an oven with proper ventilation during the microwave, thermal, and self-cleaning modes, and which, to Torrey's surprise, had no fouling problems.

In the summer of 1976, Roper marketed its oven nationally under its own name and through Sears, Roebuck &

Company under the Kenmore label. About 24,000 have been sold, with no complaints respecting contamination of the microwave feed system. The Roper oven was and is a successful product.

Torrey's February 26, 1976 application for patent issued without amendment as the '520 patent on June 7, 1977. The patented invention is depicted by this simplified drawing, shown alongside a simplified drawing of the accused Raytheon oven:


Top
Vent
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Conductor
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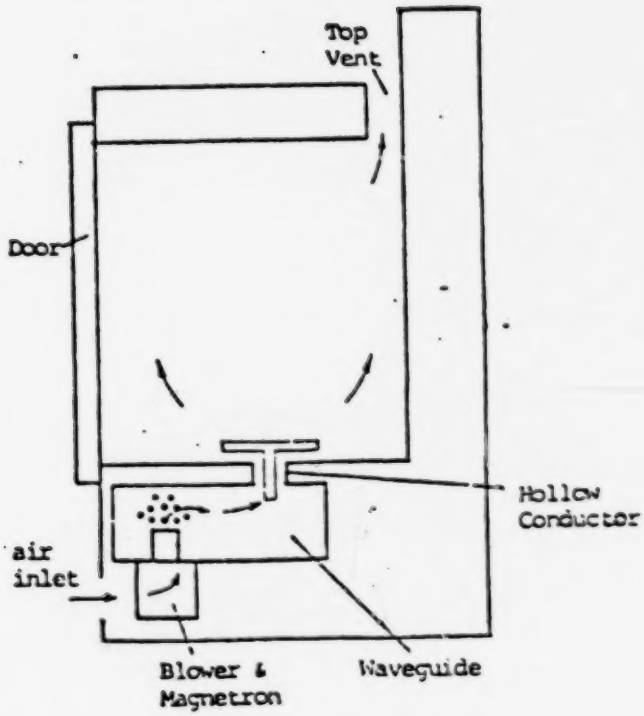
inlet
Waveguide
Blower &
Magnetron

ROPER'S OVEN



RAYTHEON'S OVEN

In the Torrey invention, the microwave entry is located at the bottom of the oven cavity. Air to remove microwave cooking moisture is forced into the cavity through the microwave system. A pattern of small passages is provided in the wall of the waveguide so that a portion of the air from the blower, which cools the magnetron, flows through the waveguide and hollow conductor. When the blower is on, the air path is from the waveguide, through the cavity and venting through the top. When the blower is off, during thermal cooking and self-cleaning, convected air ventilates the cavity via the same path. The small passages are sufficiently screened to avoid leakage of radiation. The patent specification discloses a forced air flow of three to eight cubic feet per minute (cfm) and a convection flow of 0.5 to 2.0 cfm.

There are five independent and two dependent claims in the '520 patent. Claim 5, on which claims 6 and 7 depend, is representative:

> 5. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space of conforming shape, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element within a normal temperature range for food preparation and at a high temperature level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for discharge under slight pressure to the magnetron, a waveguide having an inlet connected to the magnetron and exending under the bottom wall of the cavity to terminate at an outlet, means for connecting

the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, the waveguide being open to passage of cooling air from the magnetron so at least a portion of the pressurized air from the blower and magnetron passes through the waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected through the blower inlet, magnetron, and waveguide into the cavity for final exit through the cavity air vent at the top therof, the air passage through the blower, mangetron and waveguide being sufficiently constricted so that the air is convected in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of thermal decomposition.

All claims are reproduced in the Appendix.

C. District Court Proceedings

On September 9, 1980, Raytheon sued for a declaratory judgment that the '520 patent was invalid. Roper counterclaimed for infringement of all claims. After trial without a jury, the district court issued an opinion on January 20, 1983, and a judgment on January 28, 1983.

The district court declared the patent invalid because of a lack of

utility required by 35 U.S.C. § 101 [1] and the absence of enabling disclosure required by 35 U.S.C. § 112. [2] The district court also found that the Torrey invention was a commercial success, held

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1/ 35 U.S.C. § 101 states:

> Whoever, invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2/ 35 U.S.C. § 112, paragraph one, states:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

that the invention would have been nonobvious, [3/] and found that if the claims were valid, Raytheon would be liable for having infringed them. [4/]

3/ 35 U.S.C. § 103 states:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.

4/ 35 U.S.C. § 271(a) states:

> Except as otherwise provided in this title, whoever without authority makes, uses or sells any patented invention, within the United States during the term of the patent therefor, infringes the patent.

Because the case was not in its view an "exceptional" one, as required by 35 U.S.C. § 285, [5/] the district court refused to award attorney fees to Raytheon.

ISSUES

Did the disrict court err in (1) its judgment of invalidity under 35 U.S.C. §§ 101 and 112; (2) its holding of nonobviousness under 35 U.S.C. § 103; (3) its finding of infringement; (4) its failure to award attorney fees.

5/ 35 U.S.C. § 285 states:

> The court in exceptional cases may award reasonable attorney fees to the prevailing party.

OPINION

A. Standard of Review

Raytheon argues the evidence de novo. As Roper correctly points out, this court does not review the fact record de novo. District court findings must be accepted unless they are predicated on an improper legal foundation, see, e.g., W. L. Gore & Associates, Inc. v. Garlock, Inc., No. 83-613, Sl. Op. at 8-9 (Fed. Cir. 1983), or unless they are shown by the party challenging them to be "clearly erroneous", i.e., unless this court is left with the "definite and firm conviction that a mistake has been committed". Inwood Laboratories, Inc. v. Ives Laboratories, Inc., 456 U.S. 844, 2189 (1982). The clearly erroneous

standard applies to findings, not to legal conclusions.

B. Invalidity for lack of utility

Utility is a fact question, see, e.g., Wilden Pump v. Pressed & Welded Products Co., 655 F.2d 984, 988, 213 USPQ 282, 285 (9th Cir. 1981); Nickola v. Peterson, 580 F.2d 898, 911, 198 USPQ 385, 399 (6th Cir. 1978), cert. denied, 440 U.S. 961 (1979). In determining utility, however, the claims must first be interpreted to define the invention to be tested for utility. Claim interpretation is a legal matter subject to review free of the clearly erroneous standard applicable to fact findings. Fromson v. Advance Offset Plate, Inc., No. 83-850, Sl. Op. at 8-9 (Fed. Cir. 1983).

In this case, the district court's holding that claim 1 is invalid must be affirmed, but its holding of invalidity for lack of utility in the inventions set forth in claims 2-7 must be reversed because the latter rests on an erroneous interpretation of those claims, as well as on other incorrect legal bases.

1. The district court correctly interpreted and held invalid claim 1 but erroneously interpreted claims 3 and 4 as requiring prevention of backflow during autoignition.

In Linde Air Products Co. v. Graver Tank & Mfg. Co., 86 F.Supp. 191, 197, 75 USPQ 231, 235 (N.D. Ind. 1947), rev'd, 167 F.2d 531, 536-37, 77 USPQ 207, 212 (7th Cir. 1948), aff'd, Graver Mfg. Co. v. Linde Co., 336 U.S. 271, 277-79 (1949), certain process claims were held

invalid because they included incorrect ideas and:

> To make a claim for a . . . process in which these erroneous ideas are incorporated is to stake out a process . . . which does not in point of fact exist within the invention. While a patent covering a meritorious invention should not be struck down because the patentee has misconceived the scientific principle of his invention, the error cannot be overlooked when the misconception is embodied in the claim.

Accord, Noma Lites Canada Ltd. v. Westinghouse Electric Corp., 399 F.Supp. 243, 253, 186 USPQ 485, 493 (D.D.C. 1975) ("When an incorrect or questionable theory of operation is included in a patent claim, that claim is invalid. 35 U.S.C. § 112."). Because it is for the invention as claimed that enablement must exist, and because the impossible cannot be enabled, a claim containing a limitation impossible to meet may be held

invalid under § 112. Moreover, when a claim requires a means for accomplishing an unattainable result, the claimed invention must be considered inoperative as claimed and the claim must be held invalid under either § 101 or § 112 of 35 U.S.C. See, e.g., General Electric Co. v. United States, 572 F.2d 745, 755, 198 USPQ 65, 93 (Ct.Cl. 1978); In re Harwood, 390 F.2d 985, 989, 156 USPQ 673, 676 (CCPA 1968); CPC International, Inc. v. Standard Brands, Inc., 385 F.Supp. 1057, 1061, 184 USPQ 332, 335 (D. Del. 1974); Novelart Mfg. Co. v. Carlin Container Corp., 363 F.Supp. 58, 76, 179 USPQ 17, 29 (D.N.J. 1973). Whether the appropriate basis for holding claim 1 invalid be failure of compliance with the utility requirement of § 101 or with the enablement requirement of § 112, therefore, that holding must be affirmed.

In the present case, the district court interpreted claims 1, 3 and 4 as requiring that the inventions set forth in those claims include a means for continuing convection during autoignition. The district court found, however, that convection did not in fact occur during occasional autoignition in the Roper oven, a finding which is not clearly erroneous. Given that claim interpretation and finding, the district court was compelled under the above authorities to hold those claims invalid. However, though the district court was correct in interpreting and holding invalid claim 1, it legally erred in interpreting claims 3 and 4.

Claim 1 specifically provides: "the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are

turned off and the thermal element is turned on air is thermally convected from the blower inlet through the air passages into the waveguide and into the cavity for exiting through the cavity air vent notwithstanding the autoignition pressure which exists in the cavity under high temperature self-cleaning conditions" (emphasis added). Though, as discussed infra, the phrase is based on Torrey's erroneous theory respecting the absence of waveguide fouling, and though the functional language is introduced by "so that", we must read the phrase as the equivalent of one specifying as an element in the claim "means for continuing convection during autoignition". Because the required continuation of convection (described by the parties as "prevention of backflow") during periods of autoignition does not

and physically cannot happen, claim 1 must be held invalid. Graver Mfg. Co., supra.

The district court impermissibly read the above-quoted language from claim 1 into claims 3 and 4. The impropriety of reading limitations into claims is dramatized where, as here, the limitation sought to be added is already present in another claim. Environmental Designs, Ltd. v. Union Oil Co. of California, 713 F.2d 693, 699, 218 USPQ 865, 870-71 (Fed. Cir. 1983). Accord, Fromson v. Advance Offset Plate, Inc., supra, sl. op. at 11; Caterpillar Tractor Co. v. Berco, S.P.A., 714 F.2d 1110, 1116, 219 USPQ 185, 188 (Fed. Cir. 1983); Kalman v. Kimberly Clark Corp., 713 F.2d 760, 770, 218 USPQ 781, 788 (Fed. Cir. 1983).

In arguing that claims must be read in light of the specification, that prevention of backflow is the "essence" of Torrey's invention, and that all claims must therefore be read as including the quoted limitation of claim 1, Raytheon confuses the respective roles of the specification and claims. That claims are interpreted in light of the specification does not mean that everything expressed in the specification must be read into all the claims. On the contrary, as was said in Environmental Designs, supra, 713 F.2d at 699, 218 USPQ at 871:

> [t]he specification must be sufficiently explicit and complete to enable one skilled in the art to practice the invention, while a claim defines only that which the patentee regards as his invention. 35 U.S.C. § 112. The claim, not the specification, measures the invention. (Case cited). [T]he argument that claim 1

> must include a limitation found in the specification is thus legally unsound. Smith v. Snow, 294 U.S. 1 (1935).

Raytheon says Roper is precluded by an "appeal estoppel" from contesting the inclusion of "no backflow during autoignition" in all claims because Roper relied on "no backflow" in the district court and should not be allowed to change its theory on appeal. Examination of the trial record, however, reveals that Roper there stressed the theory it urges on appeal, and that it was Raytheon which argued that the "essence" of Roper's invention was no backflow during autoignition.

In its opening statement at trial, Roper stressed "no fouling" and various other objectives without once mentioning "no backflow" (let alone "no backflow during autoignition"). In Roper's forty-page Proposed Findings of

Fact and Conclusions of Law, Roper mentioned only once (proposed finding 79) that there is no backflow during autoignition. In its pretrial brief, Roper stated that it:

> discovered that by positioning the microwave feed system below the oven cavity, and providing an air path from an air inlet below the cavity through the microwave feed system (including the waveguide) and up into the cavity, natural convection would draw air through that path to the oven cavity and up through it to result in sufficient venting of the oven during both thermal cooking and self-cleaning. For reasons not really understood, the waveguide through which convected air flowed would not be fouled by normal autoignition pressures that occur during self-cleaning, even though the waveguide entry location at the bottom of the oven cavity would seem to be a place subject to particularly high contamination. (Emphasis added)

That is not the approach of one hinging its entire case and all the claims on "no

backflow during autoignition". The unchallenged evidence established that Roper's ovens experienced no fouling or contamination. There is no basis in the record, therefore, for the imposition of an "appeal estoppel" precluding Roper from reliance on the claims as written and allowed.

2. The district court erroneously interpreted claims 1, 2 and 5-7 as requiring the prevention of autoignition.

The district court, at Raytheon's urging, interpreted claims 1, 2 and 5-7 as requiring the prevention of autoignition. Because autoignition clearly occurs, that interpretation apparently led to the holding that those claims were invalid for lack of utility. That interpretation, however, was legally

erroneous, and Raytheon has virtually abandoned it in its briefs on appeal.

The district court apparently and incorrectly equated prevention of "autoignition" with prevention of "explosive reactions", the latter being required by claims 1, 2 and 5-7. As the district court found, autoignition occurs when the decomposition products of pryolytic self-cleaning react with some excess air to produce combustion. It is only when greater amounts of air enter the cavity that autoignition might escalate into an "explosion". Torrey did not claim to prevent autoignition; he claimed only to prevent explosions by restricting the air path to limit the excess of air to a level below that productive of explosions. As stated by Roper in its Proposed Findings of Fact and Conclusions of Law, "it is well known

in the art that one cannot completely eliminate the possibility of autoignition", and "too much air in the oven during self-cleaning causes the autoignition to become severe and even explosive". The patent itself addresses autoignition as something to be "resisted", not eliminated. Moreover, the difference in the two concepts is illustrated by claim 1's express acceptance of "autoignition pressure" and prevention of an "explosive reaction".

Thus, although claim 1 was correctly held invalid as set forth in section 1 above, there is no basis in the record on which to hold claims 2-7 invalid for lack of utility.

3. A claimed invention need not accomplish all objectives stated in the specification.

The district court held the '520 patent invalid in part because Roper's oven, as set forth in claims interpreted by the district court as requiring prevention of backflow and autoignition, failed to accomplish all objectives stated in the patent. Raytheon urged at oral argument that that holding is compelled by Mitchell v. Tilghman, 86 U.S. 287, 396-97 (1873) (a patent is void "if the described result cannot be obtained by the described means"). In Mitchell, the described result was production of fatty acids and glycerin from fatty or oily substances by the action of water at high temperature and pressure. Id. at 296, 380. That was the single result stated and was an element of the claim. Id. at 296. To

interpret Mitchell as requiring that all claims must set forth inventions satisfying all objectives would make no sense. When a properly claimed invention meets at least one stated objective, utility under § 101 is clearly shown. See, e.g., Standard Oil Co. (Indiana) v. Montedison, S.P.A., 664 F.2d 356, 375, 212 USPQ 327, 344 (3rd Cir. 1981), cert. denied, 456 U.S. 915 (1982); E.I. du Pont de Nemours & Co. v. Berkley & Co., 620 F.2d 1247, 1258 n.10, 1260 n.17, 205 USPQ 1, 8 n.10, 10 n.17 (8th Cir. 1980); Krantz and Croix v. Olin, 148 USPQ 659, 661-62 (CCPA 1966); Chisum on Patents, § 4.04[4] [1983].

Here, the Torrey invention as set forth in claims 2-7 clearly accomplished at least one, and a major one, of the patent's stated objectives, i.e., a "ventilating system for a common

cavity oven usable in all three modes of operation and which is safe in all three modes and which runs no risk of violent explosion of the products of combustion in the self-clean mode". The incorrectness of Torrey's theory explaining the absence of fouling (i.e., that continued convection prevented backflow during autoignition) does not undermine the unchallenged accomplishment of the quoted objective by the ovens set forth in claims 2-7. Torrey was attempting to explain in his specification why his tests showed no fouling, and a patentee is not responsible for the correctness of such theories and explanations when their correctness is not related to validity of the claims under consideration. See e.g., Fromson v. Advance Plate, Inc., supra, Sl. Op. at 11. (In Fromson, the

sole issue was infringement, and validity of non-asserted claims including a limitation based on the patentee's theory that an alumino-silicate layer was produced, was not before the court.)

4. Lack of utility cannot co-exist with infringement and commercial success.

The wisdom of the trial court in deciding validity and infringement, and the interrelationship of those issues, are manifested in the present case. See, Medtronic, Inc. v. Cardiac Pacemakers, No. 83-820, Sl. Op. at 43 (Fed. Cir. 1983); Gore v. Garlock, supra, al. (sic) op. at 40.

The district court's finding on infringement of claim 1 was clearly erroneous because Raytheon's proof established the impossibility of its oven having a means to continue convection

during autoignition. However, the court's finding on infringement of claims 2-7 was not clearly erroneous. See secion E, infra. That finding compels the conclusion that claims 2-7 cannot be held invalid for lack of utility.

A correct finding of infringement of otherwise valid claims mandates as a matter of law a finding of utility under § 101. See e.g., E.I. duPont de Nemours & Co. v. Berkley & Co., supra, 620 F.2d at 1258-61, 205 USPQ at 8-11; Tapco Products Co. v. Van Mark Products Corp., 446 F.2d 420, 428, 170 USPQ 550, 555-56 (6th Cir.), cert denied, 404 U.S. 986 (1971). The rule is not related, as Raytheon argues, to whether a defendant may simultaneously assert non-utility and non-infringement; a defendant may do so. The rule relates to the time of decision not to the time of trial, and

is but a common sense approach to the law. If a party has made, sold, or used a properly claimed device, and has thus infringed, proof of that device's utility is thereby established. People rarely, if ever, appropriate useless inventions.

Proof of such utility is further supported when, as here, the inventions set forth in claims 2-7 have on their merits been met with commercial success. See e.g., Medtronic, Inc., supra, sl. op. at 43; Wilden Pump v. Pressed & Welded Products Co., supra, 655 F.2d at 988, 213 USPQ at 285; CTS Corp. v. Piher International Corp., 527 F.2d 95, 105, 188 USPQ 419, 428 (7th Cir. 1975), cert. denied, 424 U.S. 974 (1976).

In sum, we hold in this section B that claims 2-7 are not invalid for lack of utility.

C. Invalidity Under 35 U.S.C. § 112

After stating that Raytheon's challenge under § 112 was largely a restatement of its challenge under § 101, the district court held that Raytheon had sustained its burden of proving invalidity under the former. We agree that the two defenses rest on the same foundation in this case. Having reversed the holding of invalidity of claims 2-7 under § 101, we accordingly reverse the holding with respect to those claims under § 112. We conclude as a matter of law that the specification of the '520 patent contains a clear description enabling one skilled in the art to make

and use the inventions set forth in claims 2-7. 6/

D. 35 U.S.C. § 103

The district court properly approached and decided the nonobviousness/obviousness issue in light of 35 U.S.C. § 103. First, it recognized the statutory presumption of validity and

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6/ Enablement under 35 U.S.C. § 112, paragraph 1, is a question of law. In re Hogan, 559 F.2d 595, 604,194 USPQ 527, 535 (CCPA 1977); In re Brandstandter, 484 F.2d 1395, 1405, 179 USPQ 286, 293 (CCPA 1973); In re Naquin, 398 F.2d 863, 866, 158 USPQ 317, 319 (CCPA 1968); In re Chilowsky, 306 F.2d 908, 909, 134 USPQ 515, 516 (CCPA 1962). Accord, Plastic Containers Corp. v. Continental Plastics of Oklahoma, Inc., 607 F.2d 885, 891-92 n.9, 203 USPQ 27, 32 n.9 (10th Cir. 1979), cert. denied, 444 U.S. 1018 (1980); Hirschfield v. Banner, 462 F.Supp. 135, 142, 200 USPQ 276, 281 (D.D.C. 1978), aff'd, 615 F.2d 1368 (D.C. Cir. 1980), cert. denied, 450 U.S. 994 (1981).

that the burden was on Raytheon to overcome it by proving facts with clear and convincing evidence. See e.g., Connell v. Sears, Roebuck & Co., No. 83-841, Sl. Op. at 13 (Fed. Cir. 1983). 7/ Second, the court neither ignored nor modified the presumption merely because Raytheon cited prior art not before the Patent Office. Citation of such art -- even when more pertinent than the art before the Examiner (which the district court correctly found was not the case here) -- does not destroy the presumption, although it may make it easier for the one attacking validity to

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7/ That presumption, stated in 35 U.S.C. § 282, also applies to utility. See e.g., Medtronics, Inc. v. Cardiac Pacemakers, Inc., supra, Sl. Op. at 6.

overcome the burden set by 35 U.S.C. § 282. See Connell, supra, Sl. Op. at 13.

Third, the district court correctly assessed the evidence in light of the factual inquiries enunciated in Graham v. John Deere Co., 383 U.S. 1 (1966).

Presumably, the district court's conclusion of nonobviousness (and finding of infringment, discussed infra) applied to all claims, although the opinion did not so state (the "patent" was declared invalid; the "claims" were found infringed). For purposes of this appeal, "the claimed invention" in what follows concerning nonobviousness and infringement may be read as in light of representative claim 5. Because the claims were not argued separately on appeal, and because differences in the claims cannot here affect the result, all

claims (except claim 1) can be seen to stand or fall with claim 5. See e.g. In re Kaslow, 707 F. 2d 1366, 1376, 217 USPQ 1089, 1096 (Fed. Cir. 1983).

1. The Prior Art

The relevant prior art encompassed microwave ovens, combination microwave-thermal ovens, and self-cleaning thermal ovens. A summary of relevant prior art teachings is contained in the "Background" section, supra. Additionally, although the prior art taught placement of a microwave feed unit below a microwave oven, it taught away from placing an open feed unit below a self-cleaning common cavity oven because the art believed the unit would be contaminated.

2. Differences Between the Prior Art and the Claimed Invention.

The claimed invention is a self-cleaning common cavity oven having, inter alia, (1) an open waveguide located at the bottom, (2) through which forced, cooling air from the blower passes during the microwave mode only, and (3) ventilation occurs via convection through the waveguide openings during the thermal and self-cleaning modes. No self-cleaning common cavity oven existing at the time of the Torrey invention embodied any of those three elements.

3. Level of Ordinary Skill in the Art

Raytheon and Roper employed people skilled in the art of designing ovens for cooking food in both microwave and thermal modes, among them graduate

engineers with substantial background and experience in the design, development, and marketing of ovens.

4. Objective Evidence of Nonobviousness

Evidence of long felt need, unexpected results and commercial success is outlined in the "Background" section, supra.

5. Conclusion on Non-obviousness

The district court concluded that Raytheon did not overcome the presumption of nonobviousness, and we agree. Raytheon has not shown these findings to have been clearly erroneous: the findings under 1-3 above; the finding that persons of ordinary skill were unable to devise a common cavity oven

with proper ventilation and a pyrolytic self-cleaning feature; or the finding that Torrey unexpectedly found that his invention worked. Those fact findings, together with those on commercial success and the prior art's teaching away from location of the open waveguide at the bottom of a self-cleaning common cavity oven, are highly probative, objective criteria fully capable of serving as a foundation for the legal conclusion of nonobviousness.

Raytheon suggests that Roper merely combined well known elements to form its oven. In the district court, Raytheon was more explicit, citing a single sentence from the opinion in Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147 (1950) ("courts should scrutinize combination patent claims with a care proportioned to

the difficulty and improbability of finding invention in an assembly of old elements"). This court has been unable to construe the cited sentence, however, "as a rule of law applicable broadly to patent cases because virtually every claimed invention is a combination of old elements", Medtronic, Inc. v. Cardiac Pacemakers, Inc., supra, slip op. at 4, and because the Supreme Court has held combinations of old elements patentable. See, e.g., United States v. Adams, 383 U.S. 39, 51-52 (1966). It is moreover simplistically unrealistic to employ a separate test of patentability for combinations of old elements when the language of the 1952 Patent Act provides no basis for either classifying patents into different "types" or for applying different treatment to different "types" of patents. Accord, Richdel, Inc. v.

Sunspool Corp., 714 F.2d 1573, 1579-80, 219 USPQ 8, 12 (Fed. Cir. 1983); Environmental Designs, Ltd. v. Union Oil Co. of Cal., supra, 713 F.2d at 698, 218 USPQ at 870.

E. Infringement

Whether an accused device infringes properly interpreted claims is a fact question. See e.g., Fromson v. Advance Offset Plate, Inc., supra, Sl. Op. at 8-9. Here, the district court apparently found infringement under the doctrine of equivalents. The test for equivalency is whether the accused device "performs substantially the same function in substantially the same way to obtain the same result" as the claimed invention. Hughes Aircraft v. United States, 717 F.2d 1351, 1361, 219 USPQ 473, 480 (Fed. Cir. 1983). The finding

on equivalency is subject to the clearly erroneous standard on review. Thomas & Betts Corp. v. Litton Systems, Inc., No. 83-537, Sl. Op. at 12-13 (Fed. Cir. 1983). Here, the district court's ultimate finding of equivalence (except in respect of claim 1) has not been shown to have been clearly erroneous.

Raytheon asserts three differences between its oven and the claimed invention. First, the former has a gap in its door, and the claim includes "a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy". Raytheon's gap precludes a finding of literal infringement but not a finding of infringement under the doctrine of equivalents. The district court found that Raytheon's gap does not materially affect entry of air, most of which comes

through the waveguide, only the most minor amounts being admitted through the gap. The district court said, "[t]he functioning of the air flow system taught in the Torrey claims is embraced by the Raytheon oven". That finding has not been shown to have been clearly erroneous.

Second, Raytheon says its oven does not prevent backflow and autoignition, and all claims should be interpreted as requiring prevention of both. As above indicated, however, only claim 1 contains a "no backflow" limitation, and no claim contains a "no autoignition" limitation. Hence, only the court's finding that claim 1 is infringed is clearly erroneous.

Third, Raytheon argues that convection air does not enter its waveguide through its blower inlet, as

required by claims 2 and 4-7, nor through the blower inlet and housing vent as called for in claim 3, but through a hole in the duct attached to its waveguide. Raytheon's convection air from its attached duct, however, "performs substantially the same function in substantially the same way to obtain the same result" as convection air from the blower inlet, and the district court's finding of equivalence in convection air inlet locations has not been shown to have been clearly erroneous.

Attorney Fees

Under 35 U.S.C. § 285, a district court may award such fees to the prevailing party in "exceptional" cases. The decision to award or deny fees is discretionary with the district court. See e.g., Orthopedic Equipment Co. v. All

Orthopedic Appliances, 707 F.2d 1376, 1384, 217 USPQ 1281, 1287 (Fed. Cir. 1983). No basis has been shown for a determination that the district court abused its discretion in denying attorney fees to Raytheon.

CONCLUSION

The district court did not err in holding claim 1 invalid, in holding that the inventions set forth in claims 2-7 would have been nonobvious, in finding claims 2-7 infringed, or in denying Raytheon's request for attorney fees. The district court did err in holding claims 2-7 invalid under 35 U.S.C. § 101 for lack of utility and under 35 U.S.C. § 112 for lack of an enabling disclosure.

Accordingly, we affirm the judgment that claim 1 is invalid, affirm

the judgment that claims 2-7 are not invalid under 35 U.S.C. § 103, affirm the judgment that claims 2-7 are infringed by the accused Raytheon ovens, affirm the denial of attorneys fees to Raytheon, reverse the district court's judgment that claims 2-7 are invalid, and remand for further proceedings consistent herewith.

AFFIRMED IN PART; REVERSED IN PART; REMANDED

APPENDIX -- CLAIMS OF ROPER PATENT

1. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element at a normal temperature level for food preparation and at a high level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply including a blower and a magnetron having cooling fins, the blower having a blower inlet for drawing in cooling air and an outlet for supplying such air

under slight pressure to the cooling fins, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, means defining air passages of limited cross section for conducting air from the magnetron into the waveguide so that a portion of the pressurized air passes through the waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected from the blower inlet through the air passages

into the waveguide and into the cavity for exiting through the cavity air vent notwithstanding the auto ignition pressure which exists in the cavity under high temperature self-cleaning conditions, the convection path of the air being sufficiently constricted so that air is convected in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of decomposition.

2. In a combined mocrowave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal

element within a normal temperature range for food preparation and at a high temperature level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for supplying under slight pressure to the magnetron with discharge of at least a portion of the air into the housing to create slight pressure therein, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy

into the cavity, means defining a pattern of small air passages from the housing to the waveguide so at least a portion of the pressurized air from the housing passes through the air passage and waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, all portions of the waveguide and housing including the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is thermally convected from the blower inlet through the small air passages and waveguide into the cavity for exiting through the cavity air vent, the convection path of the air being sufficiently constricted so that air is convected in the self-cleaning mode at a level below that which is capable of

producing an explosive reaction with the products of thermal decomposition.

3. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air from outside the housing for supplying under slight pressure to the magnetron, the cooling air being discharged from the magnetron into the

housing for creating internal pressure therin, a waveguide coupled to the magnetron and extending along the housing and under the bottom wall of the cavity, the waveguide having an outlet alined with the opening in the bottom wall of the cavity, a hollow open-ended conductor extending through the opening for coupling the outlet of the aveguide to the cavity, means for securing the upper end of the hollow conductor to the bottom wall of the cavity and the lower end of the conductor to the waveguide for conduction of microwave energy into the cavity, the wall of the waveguide having a pattern of small openings communicating with the housing so that a portion of the pressurized air from the blower and magnetron passes through the waveguide and hollow conductor into the cavity for ventilating the cavity when the magnetron

and blower are turned on, the housing having a relatively large vent opening though which the pressurized air therefrom passes outwardly to reduce the internal pressure in the housing thereby to reduce the flow of air through the pattern of small openings and into the cavity to a predetermined low level, the blower inlet and large vent opening being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on flow of air through the large vent opening is reversed in direction flowing inwardly through such vent opening into the housing and through the small openings via the waveguide into the cavity with final exiting through the cavity air vent.

4. In a combined microwave-thermal range, the combination comprising

a frame having walls defining a rectangular oven cavity and a lower space, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a magnetron and blower, the blower having a blower inlet and aranged to draw in cooling air for supplying under slight pressure to the magnetron, a waveguide coupled to the magnetron and extending under the bottom wall of the cavity, the waveguide having an outlet alined with the opening in the bottom wall of the cavity, a hollow open-ended conductor extending through the opening for

coupling the outlet of the waveguide to the cavity, means for securing the upper end of the hollow conductor to the bottom wall of the cavity and the lower end of the conductor to the waveguide for conduction of microwave energy into the cavity, an antenna element centered in the hollow conductor and projecting into the cavity for guiding microwave energy to the latter, means for conducting at least a portion of the pressurized air from the blower and magnetron through the waveguide and hollow conductor into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal element is turned on air is convected through the blower inlet, waveguide and hollow

conductor into the cavity for exiting through the cavity air vent at the top thereof.

5. In a combined microwave-thermal range, the combination comprising a frame having walls defining a rectangular oven cavity and a lower space of conforming shape, a door enclosing and sealing the front surface of the cavity against passage of air and microwave energy, a thermal element in the cavity, control means for operation of the thermal element within a normal temperature range for food preparation and at a high temperature level for a self-cleaning mode, the walls of the cavity being insulated, the bottom wall of the cavity having an inlet opening, means defining a cavity air vent at the top of the cavity, a microwave power supply having a housing including a

magnetron and blower, the blower having a blower inlet and arranged to draw in cooling air for discharge under slight pressure to the magnetron, a waveguide having an inlet connected to the magnetron and extending under the bottom wall of the cavity to terminate at an outlet, means for connecting the outlet of the waveguide to the inlet opening of the cavity for conduction of microwave energy into the cavity, the waveguide being open to passage of cooling air from the magnetron so at least a portion of the pressurized air from the blower and magnetron passes through the waveguide and into the cavity for ventilating the cavity when the magnetron and blower are turned on, the blower inlet being located at a level below the bottom wall of the cavity so that when the blower and magnetron are turned off and the thermal

element is turned on air is thermally convected through the blower inlet, magnetron, and waveguide into the cavity for final exit through the cavity air vent at the top thereof, the air passage through the blower, magnetron and waveguide being sufficiently constricted so that the air is convected in the self-cleaning mode at a level below that which is capable of producing an explosive reaction with the products of thermal decomposition.

6. The combination as claimed in claim 5 in which the constriction in the air passage through the blower inlet, magnetron and waveguide is in the form of a pattern of small openings in the wall of the waveguide and in communication with the housing, the openings being of sufficiently small dimension so as to

preclude the escape of microwave energy therethrough.

7. The combination as claimed in claim 6 in which the openings in the wall of the waveguide and the vent opening are sufficiently limited in total area as to limit the flow of air for microwave cookery to within the range of three to eight c.f.m. when the blower is on and to reduce the flow of convected air under baking and self-cleaning conditions to within the range of 0.5 to 2 c.f.m.

United States Court of Appeals for the
Federal Circuit

RAYTHEON COMPANY, Appellee,	)	
v.	)	No. 83-851 83-853
ROPER CORPORATION, Appellant.	)	

O R D E R

A petition for rehearing and a suggestion for rehearing in banc having been filed in this case,

UPON CONSIDERATION THEREOF, it is Ordered by the court that the petition for rehearing be, and the same is hereby, Denied.

The suggestion for rehearing in banc is declined.

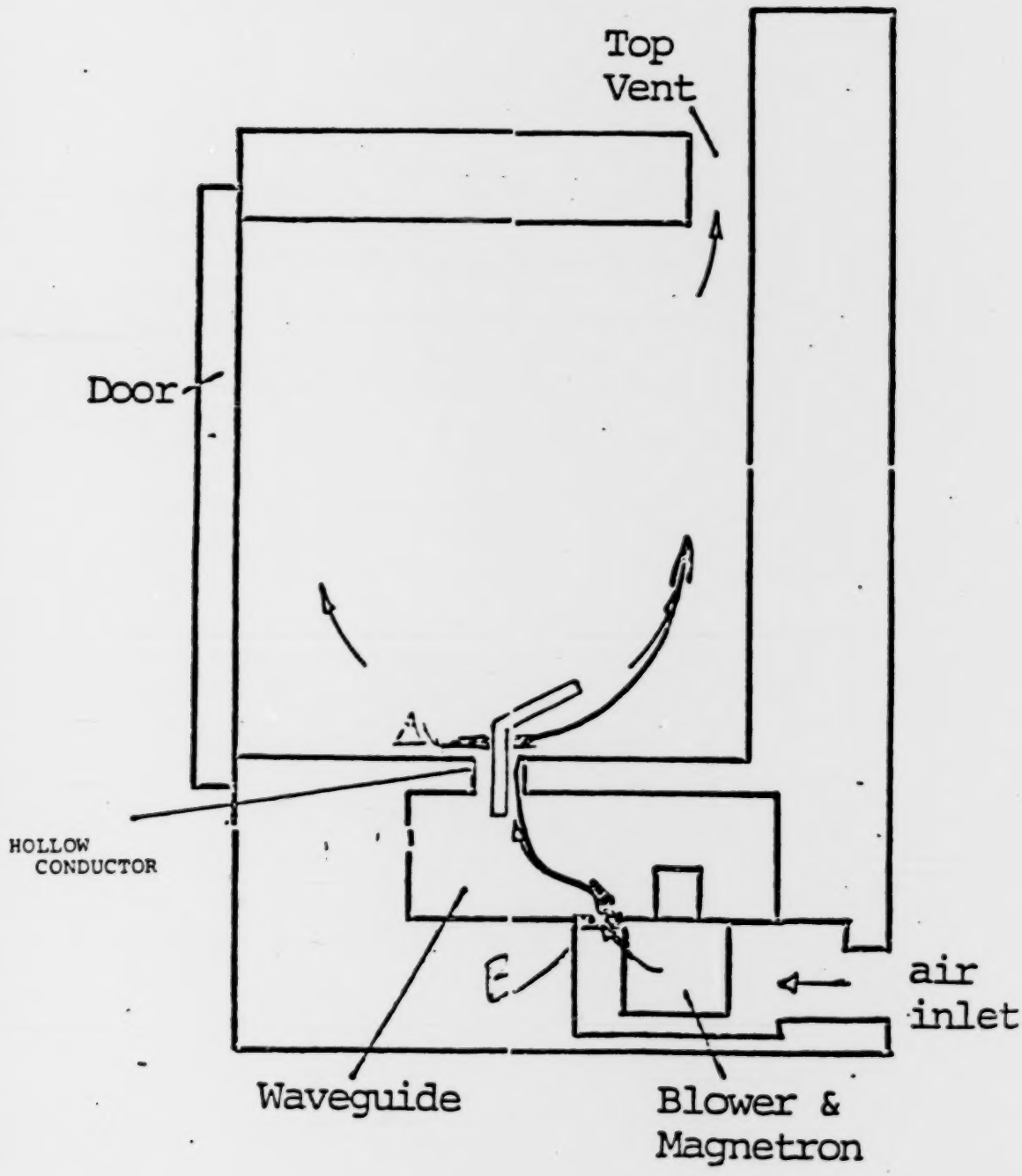
FOR THE COURT

/s/George E. Hutchinson
George E. Hutchinson,
Clerk

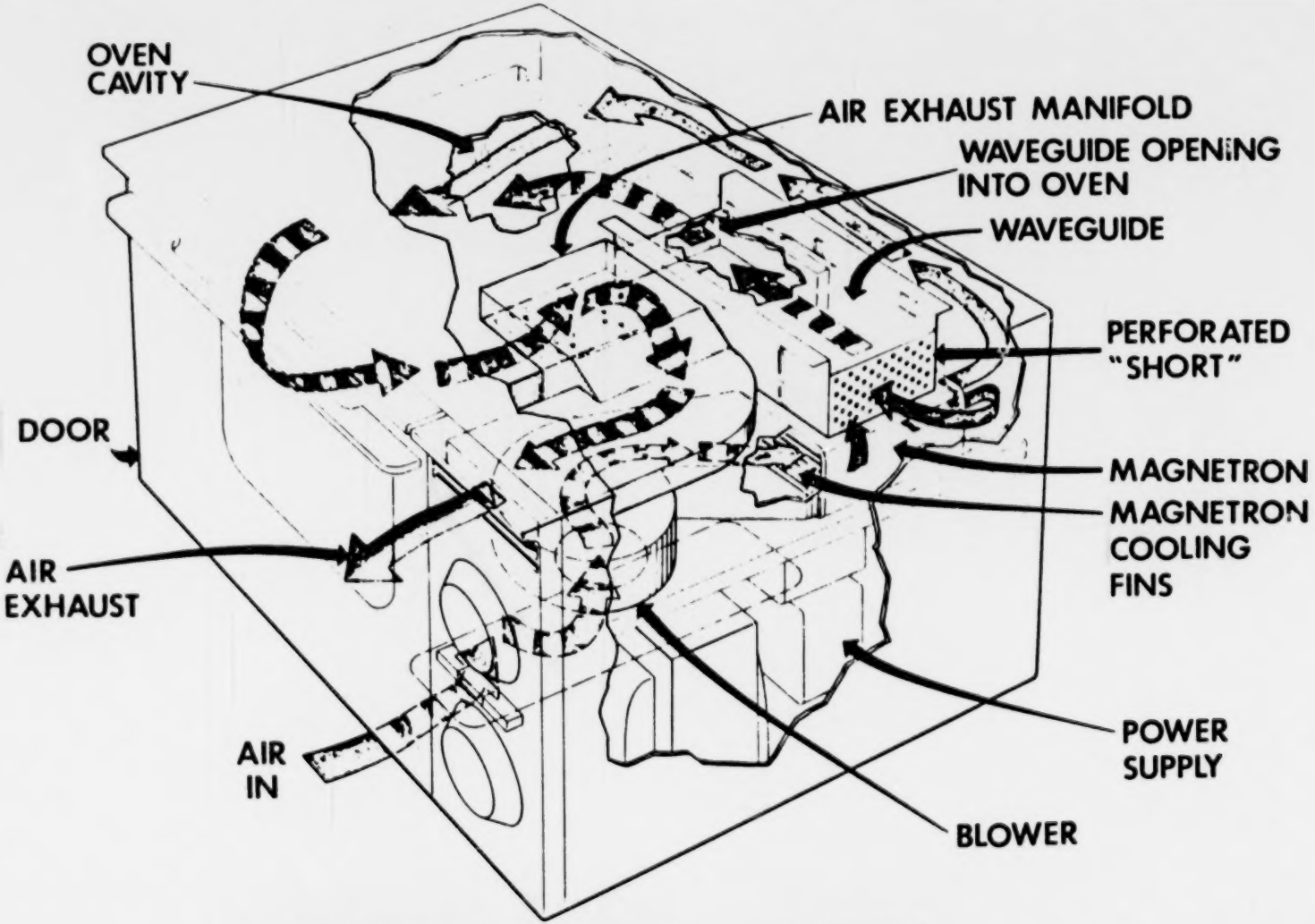
March 1, 1984
Date

cc:Frank P. Porcelli
Martin J. O'Donnell

ROPER'S EXHIBIT NO. 13



ROPER'S OVEN



AMANA RR4 OVEN

B127

ROPER TRIAL BRIEF,
September 30, 1982
(pages 3 - 4)

What severely complicates the situation is the introduction of pyrolytic self-cleaning. The basic thermal breakdown of the oven soil in pyrolysis is done without oxygen. Nevertheless, some air is needed to ventilate the oven during self-cleaning to flush the smoke and other volatile decomposition products produced by pyrolysis out of the oven through the vent located at the top of the oven. An inlet for this air is provided at the bottom of the oven cavity, often by making a gap in the oven door gasket at the bottom. However, because extremely high temperatures are involved, because the gases produced by pyrolysis may be combustible, and because there is some

oxygen present in the oven during self-cleaning, spontaneous combustion may occur right in the oven cavity during self-cleaning, particularly if the oven or the broiler is very dirty. This combustion, which is distinct from oxygen-free pyrolysis, is known as autoignition. When it occurs, it creates sudden increases in pressure within the oven cavity, and this pressure surge can cause smoke and volatile decomposition products to escape from the oven cavity through any opening. Furthermore, if excess air were allowed into the oven during self-cleaning, this autoignition phenomenon might become so aggravated and prolonged as to result in violent explosions.

Autoignition, therefore, is a serious enough concern in a standard self-cleaning oven, and many efforts have

been made to develop flame arresters and anti-flashback devices to protect air entry points into the oven. But it is far more serious in a common cavity oven. Probably the worst possible place for contamination from the smoke and decomposition products of both self-cleaning and autoignition is in the microwave feed system, and in particular the waveguide.

Thus the common cavity oven designer is faced with a dilemma. If the designer wants to incorporate a pyrolytic self-cleaning feature into a common cavity oven, the designer would normally seal up the microwave feed system and either do without adequate venting or find some other, less efficient way to effectuate it. And if the designer chooses to have forced venting through the feed system, he must give up pyrolytic self-cleaning or risk dangerous contamination of the waveguide.

ROPER TRIAL BRIEF,
September 30, 1982
(pages 7 - 8, footnotes omitted)

The Invention

Proceeding directly contrary to the thinking of the previous designers of common cavity ovens with pyrolytic self-cleaning, and to the teaching of the prior art patents that would rule out pyrolytic self-cleaning in an oven that used microwave feed system ventilation, Sumner Torrey, head of the Research Center at Roper, discovered that a pyrolytic common cavity oven could indeed be vented through the microwave feed system, if the system were properly arranged.

Specifically, he discovered that by positioning the microwave feed system below the oven cavity, and providing an air path from an air inlet

below the cavity through the microwave feed system (including the waveguide) and up into the cavity, natural convection would draw air through that path to the oven cavity and up through it to result in sufficient venting of the oven during both thermal cooking and self-cleaning. For reasons not really understood, the waveguide through which convected air flowed would not be fouled by normal autoignition pressures that occur during self-cleaning, even though the waveguide entry location at the bottom of the oven cavity would seem to be a place subject to particularly high contamination.* Based on Mr. Torrey's familiarity with the teachings of the prior art as to ventilating common cavity ovens and as to the problem of autoignition in self-cleaning ovens, the fact that waveguide fouling did not occur in this system came

as a complete surprise to him. In addition, Torrey's new system had the added benefit that the very same air path could be used for forced ventilation of the oven during microwave and combination cooking by using the blower for the magnetron to force air through the waveguide rather than rely on natural convection.**

REQUEST FOR ADMISSION NO. 23

In Roper's common cavity oven, backflow from the oven cavity to the waveguide is not prevented during auto ignition.

*****

RESPONSE

Denied. Such backflow is prevented, so that fouling does not occur, in normal self-cleaning even if auto ignition does occur. Also, such backflow is prevented so that fouling does not occur, even if the soil load is heavy. Backflow, however, may occur under some abnormally heavy conditions involving extremely heavy loads such as those used by U.L to test for fire and explosion hazards.

DEPOSITION TRANSCRIPT OF ROBERT D. TRIPLETT
Exhibit 265
(Page 58, line 14 to page 59, line 16)

Q. Well, in your discussions with those who were working on the design of the common cavity oven, did you discuss the position of the microwave feed?

A. Yes.

Q. And what was the substance of those discussions?

A. As far as I can recall, all of those discussions for product considerations or proposals were bottom fed.

Q. Were any reasons given to you for feeding from the bottom?

A. The one I recall of real merit was most eco-omical approach to the design.

Q. And it was the most convenient place to position it?

A. The most economical.

Q. Economical in what respect?

A. Manufacturing costs.

Q. Is that because there was space beneath the oven cavity to position the feed?

A. Yes.

Q. And it would be less economical, for example, to position it in back of the oven or at the top?

A. Yes.

Q. In terms of manufacturing costs?

A. Yes.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 34, lines 17 - 19)

A . . . The microwave feature by itself is not significantly different than what one might find in the prior microwave art.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 5, page 152, line 21 to page 153, line 4)

Q When operating in the microwave mode, your air flow system does not operate any differently, for example, than the RR4 oven when operating in the microwave mode, does it?

A Physically it operates no differently. The air entry point is at the bottom of the oven and one is at the top.

Q And that's the only difference, isn't it?

A Correct.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 1, page 142, line 18 to page 143, line 8)

Q Now, let's say you shut the blower off and if Boehm is suggesting you would get fouling, what is so bad about fouling?

A Fouling in the pyrolytic mode can be severe. Boehm is concerned about it just with cooking vapors, and in the self-cleaning modes you are dealing with not just grease but grease which can be raised to a high temperature and ignite within the waveguide, or you are dealing with excess air and explosions that are forcing materials back in there, such as carbon that can be generated during the cleaning

process, and I have sort of indicated what those sorts of problems can do. They can be very, very detrimental to the waveguide feed, much more so I believe than Boehm, and damage the components within the oven, as well as the magnetron and waveguide.

TRIAL TRANSCRIPT
WITNESS: HURKO
(Vol. 8, page 33, line 2 to page 34, line 18)

Q What is autoignition?

A Well, in the oven during this process, sometimes there is a right combination of air, pressure, and combustion products and temperature. And this movement flows out the ignition. So it ignites this product. It's just like to say in motor, in the motor in the car.

Q You say in a car ignition?

A Yes, in cylinder.

Q What causes ignition in the car?

A Well, the spark.

Q The spark?

A But, say, the process is similar. Now following ignition is sudden temperature

rise and pressure rise. And you may qualify this like explosion.

Q In other words, the autoignition is the beginning of the process?

A Yes.

Q When it ignites?

A When it starts.

Q And followed by an increase in pressure?

A Yes.

Q And you term that an explosion?

A Yes.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 4, page 52, line 9 to page 53, line 25)

Q Let's say as of January 1, 1974, were there waveguide dump systems which had waveguides which allowed microwave energy into an oven cavity through an opening in the waveguide directly into the cavity and through which air also passed?

A Yes.

Q And whose systems were those, who manufactured product containing that feature?

A Amana employed that method.

Q And do you know, can you name any specific products of Amana which employed that method as of that time?

A You mean by model number?

Q Yes, or any other designation by which we could perhaps recognize it, name it.

A I believe their RR4, for example, but that's only because I heard the number. I have a hard enough time with our own model numbers.

Q You are familiar with the RR4, in fact, aren't you?

A I was at one time.

Q And in fact, you were familiar with it at least as early as 1973, weren't you?

A I can't recall the date.

Q You were familiar with it prior to the time that you began development work on common cavity microwave ovens, weren't you?

A I believe that to be the case, yes.

Q And you had examined in detail an RR4 oven, hadn't you?

A I wouldn't say I examined it in detail, but I knew how it operated, yes.

Q And in fact, you had one at the Purdue Research Center didn't you?

A I suspect so. I don't know for sure, but I expect that we did at one time.

Q And it was there for the purpose of seeing how it operated, wasn't it?

A We had that, as well as other competitor products that we would operate from a cooking mode standpoint and examine them from that aspect.

Q And would normally also disassemble them to examine their

construction and internal operations?

A Yes.

TRIAL TRANSCRIPT
ROPER OPENING STATEMENT
(Vol. 1, page 11, line 3 to page 12, line 6)

Now, it was conventional thinking, up to the time that Torrey came along, that you could not have an open waveguide; that is, with its open end into the oven, if the oven were going to have a self-cleaning feature, because it was known universally, that during the self-cleaning cycle, the products of the pyrolytic treatment would back up into the waveguide, and there would be a build-up possibly of carbon and other materials which would interfere with the passage of the microwaves.

Indeed, during the self-cleaning pyrolysis cycle, sometimes with a heavy load of soil, flames will appear inside the oven, and that is one of the

reasons, of course, that in all these ovens with self-cleaning features, there is an interlock on the door so the housewife cannot open the door when self-cleaning is in progress, because if the door will open, there might be an explosion from the gases inside.

Now, that phenomenon of possible burning or possible flaming during part of the cycle, which doesn't always occur -- sometimes it does, sometimes it doesn't -- is called auto ignition. That is another term which will be used by the witnesses. If there is autoignition, it is believed that substantial build-up of pressure within the cavity occurs, and that was thought would force the products of combustion down into the waveguides; therefore, it was felt you could not have an open waveguide...

TRIAL TRANSCRIPT
ROPER COUNSEL COLLOQUY WITH COURT
(Vol. 1, page 66, line 21 to page 67, line 11)

The other thing is that perhaps I didn't make it clear that if you have a steam problem in a combination microwave oven and you solve it by letting air in through the waveguide, the industry thought the waveguide would be in jeopardy of being contaminated and said: Don't do it. Whereas, if you solve the waveguide noncontamination problem by closing it up, you can't ventilate. So that is the dilemma that Mr. Torrey solved.

THE COURT: I understand that is the initial issue, that is, was there a problem, and, if there was no problem, it is going to make this rather easy. It might make it rather easy if it

is a problem. I want to get in on the issue that I can most easily understand and deal with at the beginning. That is the issue: Was there a problem?

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 1, page 140, lines 2 - 18)

Q How would self-cleaning cause this contaminating material to go into the waveguide if you shut the blower off? At least, how was that thought to occur?

A The pressures develop due to autoignition.

Q What is autoignition?

A Autoignition is essentially a combusion (sic) producing very high pressures, unusually high, sometimes caused by burning within the oven. The burning can produce gases and smoke. And the smoke aspect also has a pressure head to it. And either one of these two can force vapors back into the oven during the

-- or back into the waveguide system in this case, during the cleaning process.

Q Which is more safer, the problem of convection flow during cooking back into the waveguide or the self-cleaning backflow problem?

A The problem with self-cleaning ovens is far worse.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 69, lines 3 - 18)

Q What does your patent teach with respect to autoignition, if it's not teaching eliminating autoignition?

A It teaches a way of living with that such that you essentially restrict or -- I guess I'm grasping for the word -- reduce the pressure. I don't want to get too technical. To backflow or flow that would go into the waveguide and create fouling.

So there is a pressure restriction within the system that we teach to prevent autoignition from fouling the waveguide, providing that autoignition is within the normal levels of consumer soils.

Q Is this a fair characterization of what you are saying, what is on Column 1 of your patent at Line 42?

A Yes, it is more specific, obviously, to provide a ventilation system which is capable of reducing autoignition pressure of the --

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 1, page 120, lines 1 - 11)

Q Which of the two, can you say which of the two is more important, the cooking vapors or self-cleaning vapors as far as keeping them out?

A Definitely self-cleaning vapors.

Q And why is that?

A Because they have far more hazards associated with the self-cleaning vapors as I indicated earlier, problems of grease and fire hazards are much more significant there.

Products of decomposing products, such as carbon, is more significant in that aspect and the problem of redeposition would be far worse.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 1, page 128, lines 13 - 20)

Q So what is the real difference as far as heat between the self-cleaning and normal cooking?

A Well, the temperature is basically the only difference. The problem really deals with the food deposits that are left in the oven cavity or deposited on the oven cavity and decomposed during the process, and this is a far more significant problem from the fouling standpoint than is normal cooking vapor.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 4, lines 14 - 20)

Q Well, why don't you just turn the blower off in a self-cleaning oven?

A The self-cleaning oven would not function with the blower being turned off from the standpoint of the reactions that take place are very high pressure and it would back up into the waveguide if it's open to the oven.

TRIAL TRANSCRIPT
ROPER COUNSEL COLLOQUY WITH COURT
(Vol. 1, page 66, line 21 to page 67, line 4)

The other thing is that perhaps I didn't make it clear that if you have a steam problem in a combination microwave oven and you solve it by letting air in through the waveguide, the industry thought the waveguide would be in jeopardy of being contaminated and said: Don't do it. Whereas, if you solve the waveguide noncontamination problem by closing it up, you can't ventilate. So that is the dilemma that Mr. Torrey solved.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 1, page 142, line 13 to page 143, line 8)

Q Does this present a dilemma, if you follow the teachings of the Boehm and French patents?

A It definitely presents a dilemma if we follow the teachings of this compared to the self-cleaning oven teachings before and the self-cleaning oven needs.

Q Now, let's say you shut the blower off and if Boehm is suggesting you would get fouling, what is so bad about fouling?

A Fouling in the pyrolytic mode can be severe. Boehm is concerned about it just with cooking vapors, and in the self-cleaning modes you are dealing with not just grease but grease

which can be raised to a high temperature and ignite within the waveguide, or you are dealing with excess air and explosions that are forcing materials back in there, such as carbon that can be generated during the cleaning process, and I have sort of indicated what those sorts of problems can do. They can be very, very detrimental to the waveguide feed, much more so I believe than Boehm, and damage the components within the oven, as well as the magnetron and waveguide.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 5, line 13 to page 8, line 6)

Q What was your solution to the problem? What was your invention?

A My invention was, basically, to locate the feed system at the oven bottom such that when you opened the air inlet and brought convective air in through the waveguide and expelled that air out through the normal vent system, the catalytic vent system, in a manner that did not foul the waveguide.

I could expand on this by indicating that once that discovery was made, we actually could have convected air flow through the oven that we could apply the blower and force air through the waveguide and

expell steam from the oven. This solved essentially all three problems that we were dealing with.

Q So how did it solve all three problems?

A It solved the problems of limiting the amount of air through the waveguide and properly expelling that out the catalytic vents such that smoke and reactions that went on in the oven were contained within the oven and the by-products of self-cleaning were expelled from the vent without any other associated problems of smoke or flame.

Q Was that because the blower was on or off?

A That's because the blower was off.

Q Okay.

A The steaming problem was solved strictly by the forced air flow with

the blower on to remove oven vapor through that same microwave feed passage and vent system to expell the vent, or, the steam in the manner that wouldn't be a consumer hazard.

The fouling of the waveguide, I believe, basically, was solved by the location of the waveguide and the fact that we had constricted air flow through that in an inlet well below the oven bottom, that the discovery indicated did not cause waveguide fouling.

Q Would placement of the feed at the bottom have been likely to have been better with respect to preventing fouling?

A It would appear,based on the teachings and my own knowledge of the product, the location on the

oven bottom perhaps would be worse than any other place in the oven due to the fact that most of the soil appears or is accumulated on the oven bottom.

Q So as opposed to somewhere else in the oven, you're saying what about putting the feed at the bottom and making it open?

A I'm saying, basically, that goes counter to all of the teachings that I saw and everything that I thought about how to deal with these problems. I did realize that if the opening were at a higher location that there would be a strong tendency by natural convection to force both cooking vapors and the by-products of combustion into that waveguide system from a natural convection standpoint, or force.

Q With respect to the problem in self-cleaning that you mentioned yesterday of autoignition, what about the placement at the bottom of the waveguide opening, would that likely cure it?

A It did not appear to me from a thought process standpoint prior to trying it that it would cure it, but apparently it did resist the pressures involved, such that it didn't foul.

Q What was your reaction when you saw it did resist the pressures of fouling?

A I was quite surprised and felt we had finally a solution to all three problems.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 74, lines 9 -20)

Q How can that be? How can this tiny pressure coming through the waveguide resist this big autoignition pressure?

A Well, I know autoignition exists, and the only theory that I've ever been able to deal with or resolve the problem deals with a fact that in the normal use, the energy content is so small that perhaps this pressure may not be great enough to overcome it, but it still does not seem reasonable to me, thus I'm in a quandary. All I know is we do not foul or waveguide because there is resistence in the system to autoignition pressures.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 75, lines 4 - 11)

Q Are you saying a combination at the bottom plus the convection?

A The bottom of the oven plus the convection, locations, and the way it's arranged. I'm not really saying convection, probably just the fact that it's limiting air entry and may provide some kind of a pressure chamber which prevents it from backing up into that waveguide.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 83, line 22 to page 84, line 25)

THE WITNESS: Pardon me?

THE COURT: You can't measure the air coming through?

THE WITNESS: We measure the flow rate, the pressures are very difficult to measure, and so you can only deal with them by equations or theory.

In other words, you can measure how much air is flowing in terms of CFM, but it's extremely difficult to measure the convected air flow in this oven because it is so small. It is on the order of inches of water. We measure blower pressures involved very accurately. In other words, the air pressure the blower generates.

THE COURT: You can measure that, but you can't measure the naturally convected air through that?

THE WITNESS: It is very difficult to measure. It is a case of trying to take a -- I don't know if we ever really tried to absolutely measure it -- but it is essentially a very, very low number, just based on equation and theory relative to what the pressures and temperatures are.

THE COURT: But somehow there is a balance in there? Somehow, however it happened, you have managed or this system manages to allow enough air to go through so that it resists air coming down and fouling the waveguide, correct? It resists a backup?

THE WITNESS: In normal cooking.

THE COURT: And self-cleaning?

THE WITNESS: Normal, after normal food soil and going through a self-cleaning process, I believe there is a restriction that prevents that which means that whatever the backkup pressures are, they are apparently either diminished so quickly or not large enough that still the convection system works.

THE COURT: You say in the self-cleaning mode, there was pressure in every --

THE WITNESS: In every direction.

THE COURT: In every direction.

So, therefore, there would be pressure down into the waveguide?

THE WITNESS: Yes.

THE COURT: Somehow that pressure becomes resisted or dissipated?

THE WITNESS: Correct.

THE COURT: And the only explanation is from the convected air up through the waveguide, there is no other explanation for that, is there?

THE WITNESS: I don't believe there is any other real good explanation. At the same time, it surprises me.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 85, lines 1 - 17)

THE COURT: Yes, I understand it. You may not know how it works, and that many not make any difference; but something is happening to resist the downward pressure into the waveguide. At the same time, if I understand you, this naturally convected air is not so large as to add to the pressures already in the cavity to provide more -- to provide an explosion due to the greater increases in air.

You see what I mean? It prevents autoignition. It doesn't prevent it, it doesn't help it.

THE WITNESS: It doesn't prevent it, but there is no dangerous condition caused when it occurs.

THE COURT: So it is so low it can't assist in the production of autoignition and, yet, it is high enough to resist the effect of that autoignition downward into the guide?

THE WITNESS: I could buy that.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 5, page 56, line 13 to page 57, line 16)

[Q] What does Newton's law tell you under those conditions? When you have two pressures diametrically opposed to each other, one of which is up to 100 times as great as the other, what does Newton's law tell you about the direction in which matter will go?

A One would expect the greater pressure to dominate, the motion would go in the direction of the greater pressure.

Q In other words, you would expect the materials flow right into that waveguide from the oven through the aperture A?

A This is what I expected and was concerned about from the very

beginning of how to treat convected flow rate in a common-cavity pyrolytic oven.

Q This is a fundamental exception to Newton's laws that you have discovered, isn't it?

A I don't consider it a fundamental exception.

Q One unit of pressure can resist 100 units of pressure, that's fundamental, isn't it? This is the first time there has been such an extraordinary exception in nonrelativistic physics?

A You are dealing with fluidic theory, or whatever theory you want to, I am just saying that we have a system that apparently --or does -- resist fouling, redeposition in spite of all that we have been discussing here. And I don't know how it

works. I have said I don't know how it works.

All I know is it works.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 5, page 58, lines 5-20)

[Q] Have you written any papers to teach the scientific community or engineering community about this very fundamental exception to the basic laws of physics that you have discovered?

A Obviously not. I have a patent, and that is the only thing that has been written that I know of.

Q Have you tried to explore it? Have you tried to test it?

A No.

Q You haven't done any measurements, have you, which would give any substance or credence to your theory that a pressure of one-tenth of a pound per square inch can somehow,

mysteriously, magically, outweigh a pressure of 100 pounds -- 14 to 100 pounds per square inch, have you?

A No.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 3, page 105, lines 1 - 22)

Cross Examination by Mr. O'Donnell

Q Mr. Torrey, I take it that you now admit that the air vent system that you say you have developed now does not prevent all backflow down through the waveguide from the oven cavity, is that correct? We don't have any more question about that now, do we?

A I have no question about the fact thatit (sic) does prevent. It's just a case of what the conditions are that it prevents.

Q Does it prevent all backflow into that waveguide?

A Obviously it does not prevent all backflow from a standpoint of UL conditions.

Q Does it prevent all backflow into that waveguide, Mr. Torrey?

A As far as I am concerned from the interpretation of the patent, it takes care of all backflow in the waveguide.

Q Is backflow physically prevented into that waveguide?

A I believe there is resistance to the autoignition in the reaction to take place in the oven.

TRIAL TRANSCRIPT
ROPER OPENING STATEMENT
(Vol. 1, page 11, lines 3 - 12)

Now, it was conventional thinking, up to the time that Torrey came along, that you could not have an open waveguide; that is, with its open end into the oven, if the oven were going to have a self-cleaning feature, because it was known universally, that during the self-cleaning cycle, the products of the pyrolytic treatment would back up into the waveguide, and there would be build-up possibly of carbon and other materials which would interfere with the passage of the microwaves.

TRIAL TRANSCRIPT
ROPER OPENING STATEMENT
(Vol. 1, page 11, line 22 to page 12, line 6)

Now, that phenomenon of possible burning or possible flaming during part of the cycle, which doesn't always occur -- sometimes it does, sometimes it doesn't -- is called auto ignition. That is another term which will be used by the witnesses. If there is autoignition, it is believed that substantial build-up of pressure within the cavity occurs, and that was thought would force the products of combustion down into the waveguides; therefore, it was felt you could not have an open waveguide...

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 5, page 2, line 1 to page 5, line 23)

SUMNER H. TORREY, Resumed

CROSS-EXAMINATION BY MR. O'DONNELL, Continued

Q Mr. Torrey, will you please tell us what you mean by backflow?

A By backflow I mean the products within the oven cavity such as air, vapors, and in the case of self-cleaning, products of degradation can be, shall we say, pushed back into an air entry system into that cavity.

Q How about a waveguide?

Now, let's assume for the moment, let's accept your statement at face value for some unexplained

reason the air and vapor which we will just call generically vapor including air and all the other products that may be in the oven, grease, et cetera -- let's assume for some reason the vapor doesn't flow into the waveguide as you tell us, but if it did, would that be backflow?

If vapor did come into the the waveguide from the oven, would you call that backflow?

A If you would define "vapors" as any contaminants in the oven whatever, yes.

Q Air, grease --

A I would say collectively, not individually.

Q Okay.

So we'll understand vapors

to include whatever is in the oven, not referring to any separate part but whatever is in the oven at any particular time, is that fair enough?

A Well, self-clean, in the self-cleaning mode dominantly.

Q Thermal mode, also, vapors are in the thermal mode?

A Correct.

Q And there are present vapors in the self-cleaning mode?

A Yes.

Q If any of those vapors were to flow back into the waveguide, would you say that is backflow?

A Yes.

Again, I didn't hear the word "particulates," but if that's included, yes.

Q So if anything comes from the oven into the waveguide, you would consider that backflow, is that correct?

A Not "anything," but anything that's a contaminant.

Q What would you consider coming back into the waveguide that would not be backflow?

A I would see nothing harmful about air, nothing harmful about vapors that don't cause fouling.

Q In your definition of the word, the term "backflow," you exclude anything that might cause fouling, is that correct?

I'm sorry, includes only that which could cause fouling and excludes everything else?

A I believe that's the essence of the invention is to prevent fouling.

Q Now, is there some mechanism which separates the harmful constituents, that is those constituents which would lead to fouling, from those constituents which would not lead to fouling?

Is that another magic feature of this invention?

A When you are talking about "mechanism," I really don't know how the invention works, and, therefore, I have a difficult time answering that specific question.

Q Do you believe that there is anything in the air flow system that you say you developed that separates out from entry into the waveguide constituents which would cause fouling from constituents which would not cause fouling?

A I believe there is a resistance, but I can't define the mechanism that does any separation, no.

Q There is no differential resistance to the various constituents, is there?

There is nothing you have incorporated that would cause you (sic) waveguide to resist entry of one product more than another, isn't that correct?

A That's correct.

Q So that if anything from the oven comes into the waveguide, you have a backflow into the waveguide, don't you?

A Would you repeat the question, please?

Q If anything from the oven comes into the waveguide, you have a backflow, don't you?

A In that condition, yes.

Q Whether or not that backflow contains vapors that would cause fouling, it is a backflow, isn't it?

A Yes.

Q And there is nothing in your invention that prevents that backflow, is there?

A I'm not sure that there isn't anything in the invention. The fact that we do not get vapors indicates there is some mechanism in there -- or fouling of the waveguide, I should say -- indicates some mechanism exists that prevents that.

Q Do you know of any such mechanism? Can you identify any such mechanism?

A I theorized it could be the convected flow as a resisting means, I have also indicated it could be the fact that there is some vertical

shielding in the inside of the oven cavity relative to any vertical direction of backflow impacting on the bearing cover.

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No. 83-2128

In the Supreme Court of the United States

OCTOBER TERM, 1983

RAYTHEON COMPANY,
PETITIONER,

v.

ROPER CORPORATION,
RESPONDENT.

BRIEF IN OPPOSITION TO PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT

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I

Counterstatement of the Question Presented

Is a patented invention for an oven ventilation system, which was found by both the District Court and the Court of Appeals to be unobvious and clearly infringed, also "useful" under the patent statute, when the claimed invention unquestionably performs the very useful ventilation function described in its patent specification and has been successfully incorporated in 24,000 of the respondent's ovens and over 36,000 of the petitioner's infringing ovens?

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Counterstatement of the Case

As noted by the Court of Appeals for the Federal Circuit in its opinion below, petitioner Raytheon Company (hereinafter "Raytheon") ignored most of the findings of fact of the District Court and attempted on appeal to argue the evidence *de novo* (B76).[1] Although this attempt was unsuccessful, Raytheon has taken the same approach here in its Statement of the Case. As a result, respondent Roper Corporation (hereinafter "Roper")[2] believes this counterstatement is warranted.

[1] The references herein are to the Petitioner's Appendices A and B, and most relate to the findings of fact or conclusions of law of the District Court or to the opinion of the Court of Appeals for the Federal Circuit.

[2] With reference to Rule 28.1 of the Rules of the Supreme Court of the United States, Roper has no parent companies and one not wholly owned subsidiary, Wadsworth Control Systems, Inc., a Colorado corporation. Sears, Roebuck and Company, however, does own a portion (less than 50%) of Roper stock.

Roper owns U.S. Patent No. 4,028,520 issued to Sumner H. Torrey (hereinafter "the Torrey patent"), which covers a ventilation system for a unique type of oven called a common cavity oven. A common cavity oven has three basic modes of operation: (1) conventional thermal cooking, (2) microwave cooking, and (3) pyrolytic self-cleaning (B4). These multiple functions all take place in the same oven cooking chamber, called the oven cavity; hence the name "common cavity" (B4). As found by the District Court these three oven modes of operation were not entirely compatible from an oven ventilation standpoint, at least prior to the Torrey invention (B5-6).

Most foods give off grease-laden vapors ("steam") as they cook, and these vapors tend to collect inside the oven cavity. In conventional thermal ovens, this steam is removed by creating an air flow through the oven cavity so that the steam is flushed through a vent in the oven top (usually in the control panel area). This air flow is often created by providing a small access opening to the oven cavity at the bottom of the oven door. When the oven cavity heats up because of the cooking process, air from outside the oven is convected into the oven cavity through the access opening. The air flows through the oven cavity and up and out the top vent, sweeping the steam along with it (B6).

This small convected air flow, however, is inadequate to properly ventilate a microwave oven. In microwave cooking, the food cooks much faster and the steam collects much more rapidly (B7). This substantial amount of hot "steam" from microwave cooking is also a potential safety hazard, for when the oven door is first opened, the collected steam can rush out of the oven and into the oven operator's face (B10). As a result, the ventilating air flow through the oven cavity must be increased during microwave cooking to prevent steam build-up, and this is most often accomplished by making additional use of some of the already-existing microwave oven structure (B7).

In a microwave oven, microwaves are generated by an electronic tube called a magnetron, and the microwaves then pass into a hollow metal waveguide which directs the microwaves into the oven cavity. The microwave-generating magnetron heats up when in use, and a fan forces cooling air over it whenever the magnetron is on (B6-7). Some of this blown air can be channeled to pass into the hollow waveguide, and by opening up the end of the waveguide to the oven cavity, this blown air will also flow into the oven cavity itself and ventilate the oven during microwave cooking (B7, B11).

If thermal and microwave cooking are combined in the same oven cavity (the "common cavity" oven), the prior art taught (and the District Court found) that this strong flow of forced air must be sent through the open waveguide even during thermal cooking because of a problem known as waveguide fouling (B10-12). If the waveguide is simply left open, steam or cooking vapors from the thermal cooking process will flow back into the open waveguide and deposit on and contaminate the waveguide's inside walls, adversely affecting oven performance (B11-12). The strong flow of forced air through the waveguide, however, would keep the conventional cooking vapors out, and no fouling would occur. Thus, the waveguide would be protected from fouling by blowing air through it during both microwave cooking and thermal cooking.

When pyrolytic self-cleaning is added to the common cavity oven, the ventilation problem becomes more complicated. Pyrolytic self-cleaning involves heating the oven walls to about 900°F. to pyrolyze the soil on the walls, producing airborne byproducts that need to be ventilated out of the oven. The potential for waveguide fouling during self-cleaning exists because of these airborne byproducts. As found by the District Court, the basic solution of continuously blowing air through the waveguide to prevent fouling could not be used where pyrolytic self-cleaning is part of the oven (B7-9). This is

because of an effect called autoignition. Autoignition is an infrequent and momentary combustion, involving a very brief but significant increase in the temperature and pressure inside the oven cavity (B8). Under normal household self-cleaning conditions autoignition is mild and infrequent (B24). Autoignition, however, becomes a violent explosion, capable of blowing open the oven door, buckling the oven floor and possibly resulting in a sustained fire inside the oven cavity (B8, B64) if the air flow into the oven is above a certain very low level. The amount of forced air needed to keep vapors and byproducts out of the waveguide would be well above this safety limit (B8-9, B12).

As found by the District Court, the prior art common cavity oven makers were unable to protect the open waveguide in all three modes by blowing air through it, and, therefore, they protected the waveguide from fouling by sealing the oven cavity end of it (B10, B13, B64-65). As a result there was no forced air ventilation in those ovens during microwave cooking, and those prior art ovens had serious steam problems (B10, B40, B65).

With this the state of the art in 1973, the respondent, Roper, began development of its own common cavity oven with self-cleaning (B16). Sumner Torrey, a Roper senior development engineer, designed Roper's prototype (B18). Torrey discovered that a self-cleaning, common cavity oven could indeed be ventilated in all three modes of operation (microwave cooking, thermal cooking and pyrolytic self-cleaning) without waveguide fouling, if the system were properly arranged and certain operating conditions were followed.

Initially, Torrey positioned the waveguide below the oven cavity and opened it at the bottom of the cavity. He then arranged an air passageway from an air inlet below the oven cavity through the open waveguide and up into the oven cavity. Naturally convected air was then drawn through the waveguide and into the oven cavity during thermal cooking

and self-cleaning. Air was blown through the same passageway during microwave cooking (B18-20). A simplified, cross-sectional side view of an oven embodying the Torrey ventilation system is shown in both the District Court's opinion (B57) and in that of the Court of Appeals (B67).

Because of Torrey's invention, for the first time a self-cleaning common cavity oven was properly ventilated in all three modes (thermal, microwave and self-cleaning). As found by the District Court, this was something never before accomplished (B41).

Raytheon throughout this entire litigation has *never once denied* the following: if one took the Torrey patent and built the structure disclosed in it, the end result would be a working self-cleaning common cavity oven which ventilates properly in all three modes of operation, which exhibits no waveguide fouling, and which limits the air intake to below the level at which self-cleaning autoignitions become violent explosions —an entirely useful result not accomplished by the prior art. Indeed, this is precisely the major object of the invention, as set forth in the patent itself ((A7), col. 1, lines 55-59):

> "*It is a general object to provide a ventilating system for a common cavity oven usable in all three modes of operation* and which is safe in all three of the modes and which runs no risk of violent explosion of the products of combustion in the self-clean mode." (Emphasis ours.)

And it is this major object which the Court of Appeals found was met by the invention of claims 2 to 7 of the Torrey patent (B91-92).[3]

---

[3] The best Raytheon can do in its Petition is to repeatedly allege that this general object is also met by the prior art ovens (e.g., Petition pp. 28-29), a position it has never before taken in the few years this case has been pending. The reason Raytheon never raised this argument before is that it is false and directly contrary to the findings of fact below. As found as fact by the District Court, and unchallenged by Raytheon on appeal to the Court of Appeals, the prior art ovens did not ventilate during one of the three modes of operation, microwave cooking, because the waveguides were sealed to prevent fouling (B9-10, B14).

Roper introduced its common cavity oven with the Torrey ventilation system to the market in 1976, and as found by the District Court it became a very successful commercial product with some 24,000 sold, none of which ever exhibited any steaming problems or waveguide fouling (B22).

Raytheon began its development of a self-cleaning common cavity oven in early 1975 (B22). After about fourteen months of effort, however, Raytheon's prototype oven cooked poorly and had a serious steam problem during microwave cooking (B23). In January, 1976, however, Buddy J. Austin, who was one of Torrey's key engineers on Roper's common cavity project, joined Raytheon's subsidiary, Amana, and was immediately put to work on Raytheon's floundering common cavity project (B23-24). Within about a month, Raytheon's oven changed dramatically (B24-25), and, as found by the District Court, the result was a virtual copy of Roper's oven including Torrey's unique ventilation system (B27).

Raytheon then put its common cavity oven on sale, and Roper charged Raytheon with infringement. Raytheon brought suit in the District of Massachusetts for a declaratory judgment that the Torrey patent was invalid and not infringed by Raytheon's oven.

On January 20, 1983, the District Court found that the Torrey ventilation system was completely unobvious (B39-43) and that the Torrey claims were indeed clearly infringed by the Raytheon ovens (B48-53). However, relying both on Raytheon's oven tests which were, as noted by the Court, "not typical of normal use" (B22), and Raytheon's argument (which it presents here) that the real invention was not a ventilation system at all (B43), the District Court concluded that the Torrey ventilation system, which accomplished what no other such system had done before and which had been incorporated in almost 60,000 Roper and Raytheon ovens, "lacked all utility". The Torrey patent was held invalid. Roper appealed on the utility issue, while Raytheon cross-appealed on the issues of non-obviousness and infringement.

On December 30, 1983, the Court of Appeals for the Federal Circuit (CAFC) reversed the District Court's decision as to lack of utility for claims 2 to 7 of the Torrey patent, and affirmed the lower court's decision as to non-obviousness and infringement. Raytheon sought a rehearing, which was denied, and Raytheon has now petitioned for certiorari, once again essentially asserting that the Torrey ventilation system, which it copied into over 36,000 of its ovens, lacks all utility, a claim it has to date neglected to tell its common cavity oven customers.

Summary of the Argument

I. Petitioner Raytheon's effort to create a conflict with prior decisions of this Court misstates what the Court of Appeals said and misinterprets a single remark in *Mitchell* v. *Tilghman*, 86 U.S. (19 Wall.) 287 (1873). The Court of Appeals never said that utility unrelated to the problem to be solved by the patent would suffice. And *Mitchell* v. *Tilghman* does not say that all claims of a patent must meet *all* objects stated in the specification.

II. It is simply a matter of common sense that Raytheon, having been adjudicated an infringer of certain of the Torrey patent claims, cannot thereafter be heard to argue that what it infringed is useless. However, Raytheon was never prevented from simultaneously arguing at trial non-infringement and lack of utility. The estoppel to deny utility was invoked only after infringement was determined.

III. The CAFC did not violate F.R.Civ.P. 52(a) in construing claims 2-7 as not requiring prevention of backflow. It has long been settled, including by a long line of authority in this Court, that construction of the claims is a question of law.

IV. Raytheon's argument that appeal estoppel precluded Roper from contending that the patent was directed to a ventilation system, rather than a backflow prevention device, is not supported by the trial record, as the CAFC correctly pointed out in its opinion.

Argument

I. The Decision of the Court of Appeals Is Not in Conflict With Applicable Decisions of This Court.

Essentially Raytheon's whole effort to create a conflict with prior decisions of this Court is grounded on a misreading of the CAFC's opinion and a misinterpretation of a single remark in *Mitchell* v. *Tilghman*, 86 U.S. (19 Wall.) 287 (1873).

Raytheon erroneously alleges that the Court of Appeals held that a showing of utility for some purpose, even if that was not the purpose for which the patent was granted, would satisfy the statutory requirement of utility (35 U.S.C. §101) (Pet. 25). To the contrary, the CAFC held that the inventions claimed in claims 2-7 of the patent in suit all met at least one *stated* object of the invention, and a major one at that. This was the general object of providing a "ventilating system for a common cavity oven usable in all three modes of operation and which is safe in all three modes and which runs no risk of violent explosion of the products of combustion in the self-clean mode" (A7, col. 1, lines 55-59). Raytheon's suggestion, without any supporting evidence, that this object had no relation to why the patent was sought in the first place not only ignores the very title of the patent ("Air Flow System For Common Cavity Oven"), but more importantly, ignores the strictures of F.R.Civ.P. Rule 52(a). For the District Court found as fact, and the CAFC agreed, that persons of ordinary skill (including the major manufacturers Litton and General Electric) were unable to devise a common cavity oven with proper ventilation and a pyrolytic self-cleaning feature prior to the Torrey invention (B40-41; B102-3). In other words, contrary to the concurrent findings of the two lower courts, Raytheon asserts now that this object was meaningless because it was already met by "every *self-cleaning* oven on the market prior to the time of the alleged invention". This assertion is absurd on its face because the general object is clearly limited to *common cavity* ovens with self-cleaning (the three modes are

microwave cooking, thermal cooking, and self-cleaning), and the assertion is unsupported by any evidence, because the prior art GE and Litton ovens did not have proper ventilation, a finding of fact unchallenged by Raytheon before the Court of Appeals.

Significantly, Raytheon nowhere denies that the inventions of claims 2-7 all meet this important, central and hitherto unachievable stated objective. Nor does any decision of this Court cited by Raytheon hold that such an achievement does not satisfy the statutory requirement of utility.

Raytheon's misplaced reliance on *Mitchell* v. *Tilghman*, 86 U.S. (19 Wall.) 287 (1873), was correctly pointed out by the CAFC and never effectively rebutted in the Petition. We cannot improve upon Chief Judge Markey's analysis (B90-91)[4]:

> "3. A claimed invention need not accomplish all objectives stated in the specification.
>
> The district court held the '520 patent invalid in part because Roper's oven, as set forth in claims interpreted by the district court as requiring prevention of backflow and autoignition, failed to accomplish all objectives stated in the patent. Raytheon urged at oral argument that the holding is compelled by *Mitchell* v. *Tilghman*, 86 U.S. 287, 396-97 (a patent is void "if the described result cannot be obtained by the described means"). In *Mitchell*, the described result was production of fatty acids and glycerin from fatty or oily substances by the action of water at high temperature and pressure. *Id.* at 296, 380. That was the single result stated and was an element of the *claim*. *Id.* at 296. To interpret *Mitchell* as requiring that all claims must set forth inventions satisfying all objectives would make no sense. When a properly claimed invention meets at least one stated objective,

[4] We note in passing that the holdings with regard to claim construction and lack of operability in *Mitchell* v. *Tilghman* were overruled in *Tilghman* v. *Proctor*, 102 U.S. 707 (1880).

utility under §101 is clearly shown. *See e.g.*, *Standard Oil Co. (Indiana)* v. *Montedison, S.P.A.*, 664 F.2d 356, 375, 212 USPQ 327, 344 (3rd Cir. 1981), *cert. denied*, 456 U.S. 915, 102 S.Ct. 1769, 72 L.Ed.2d 174 (1982); *E. I. duPont de Nemours & Co.* v. *Berkley & Co.*, 620 F.2d 1247, 1258 n.10, 1260 n.17, 205 USPQ 1, 8 n.10, 10 n.17 (8th Cir. 1980); *Krantz and Croix* v. *Olin*, 148 USPQ 659, 661-62 (CCPA 1966); Chisum on Patents, ¶4.04[4] [1983]."

Nor is there any conflict with *O'Reilly* v. *Morse*, 56 U.S. (15 How.) 62, 119 (1853), or *Beidler* v. *United States*, 253 U.S. 447, 453 (1920) (Pet. 29-30). The language in *O'Reilly* is the same as that in *Mitchell* v. *Tilghman*, and the quotation from *Beidler* makes clear that the patent was struck down there because the description in the patent did not enable one following it to achieve a useful result (properly developed photographs). Here, Raytheon has never denied that by following the description in the Torrey patent one would obtain a common cavity oven that has proper ventilation in all modes and is safe to the user, as evidenced by the 24,000 ovens sold by Roper and having no ventilation or explosion problems, as found by the District Court (B22), and over 36,000 more infringing ovens sold by Raytheon. That the CAFC found this a useful result was a matter of common sense.

II. Once the Petitioner Was Determined To Be an Infringer, Its Argument That It Copied a Worthless Invention Was Properly Given Little Weight

It is virtually black letter law that once infringement is found, the infringer is estopped to assert lack of utility of the invention in question. This has been the Supreme Court's position in *Lehnbeuter* v. *Holthaus*, 105 U.S. 94 (1881); *Western Electric Co.* v. *LaRue*, 139 U.S. 601, 608 (1891); *Gandy* v. *Main Belting Company*, 143 U.S. 587, 595-96 (1892); *DuBois*

v. *Kirk*, 158 U.S. 58 (1895) and *Westinghouse Co.* v. *Wagner Mfg. Co.*, 225 U.S. 604 (1912).

This line of authority has been uniformly followed by courts up until this day, including in the recent cases of *E. I. duPont de Nemours* v. *Berkley & Co., Inc.*, 620 F.2d 1247 (8 Cir. 1980); *Tapco Products Co.* v. *Van Mark Products Co.*, 446 F.2d 420 (6 Cir. 1971), and *Miller* v. *Daybrook-Ottawa Corp.*, 291 F.Supp. 896 (N.D. Ohio 1968).

And the rule makes perfect sense. In fact, in totally rejecting the same argument that Raytheon makes here (that this estoppel doctrine "reads §101 out of the patent statute"), the CAFC said (B94-95):

> "A correct finding of infringement of otherwise valid claims mandates as a matter of law a finding of utility under §101. *The rule is not related, as Raytheon argues, to whether a defendant may simultaneously assert non-utility and non-infringement; a defendant may do so.* The rule relates to the time of decision, not to the time of trial, and is but a common sense approach to the law. If a party has made, sold, or used a properly claimed device, and has thus infringed, proof of that device's utility is thereby established. People rarely, if ever, appropriate useless inventions." (Emphasis ours.)

Raytheon, of course, did not choose here to point out any error in the Court of Appeals' analysis and instead simply repeats the argument that failed below.

III. The Decision of the Court of Appeals Is in Conformity With F.R.Civ.P. Rule 52(a).

Raytheon accuses the CAFC of violating Rule 52(a) (Pet. 53) and turning away from "nearly two centuries of precedent in this Court" (Pet. 49). It is Raytheon, however, which has ignored the precedents of this Court. The CAFC correctly

held, consistently with this Court's precedents, that construction of the claims is a question of law and went on to find that the District Court had, as a matter of law, misconstrued claims 2-7 (B81-89).

This Court long ago determined that construction of the patent and of the claims is a question of law. *Silsby* v. *Foote*, 55 U.S. (14 How.) 218, 225 (1852); *Winans* v. *Denmead*, 56 U.S. (15 How.) 330, 338 (1853); *Bates* v. *Coe*, 98 U.S. 31, 38-39 (1878), and *Coupe* v. *Royer*, 155 U.S. 565, 579 (1895). Indeed in the very opinion earlier cited by Raytheon, *Beidler* v. *United States*, 253 U.S. 447 (1920), this Court stated (253 U.S. at 451):

> "Treating this finding by the [lower] court as an interpretation of the patent and, therefore, as a conclusion of law...."

More recently, many circuit courts of appeals in addition to the CAFC have reached the same conclusion: *Devex Corp.* v. *General Motors Corp.*, 667 F.2d 347, 357 (3 Cir. 1981), *aff'd on other grounds*, 103 S.Ct. 2058 (1983); *Ebeling* v. *Pak-Mor Mfg. Co.*, 683 F.2d 909, 911-912 (5 Cir. 1982); *Vulcan, Inc.* v. *Fordees Corp.*, 658 F.2d 1106, 1111 (6 Cir. 1981); and *Solomon* v. *Renstrom*, 150 F.2d 805, 807-8 (8 Cir. 1945).

Hence, the CAFC did not violate Rule 52(a) and was in conformity with this Court and other circuits when it construed the claims. Nor does Raytheon cite any contrary authority. *Graver Mfg. Co.* v. *Linde*, 338 U.S. 605 (1950), cited by Raytheon at Pet. 53, simply holds that the issue of equivalence is a question of fact. The CAFC agreed and in this case found that the District Court's finding of equivalence was subject to the Rule 52(a) clearly erroneous standard (B105-6), and was not clearly erroneous. Likewise, Raytheon's reliance on *Graham* v. *John Deere Co.*, 383 U.S. 1 (1966), (Pet. 50) is also misplaced. *Graham* held that a determination of non-obviousness had to be based upon three *factual* inquiries. Here

the CAFC reviewed the District Court's findings of fact underlying its determination of non-obviousness and found them not clearly erroneous.

In all, the CAFC opinion is an excellent example of the proper scope of appellate review of issues of claim construction, utility, non-obviousness and infringement.

IV. The Petitioner's "Appeal Estoppel" Argument Was Properly Rejected by the Court of Appeals After It Reviewed the Trial Court Record.

Raytheon apparently realized that it was impossible to prove that the Torrey ventilation system did not ventilate the oven properly (its own 36,000 infringing ovens being a big hurdle on that score), and took a different tack on the question of utility. Raytheon set out to convince both the trial court and the CAFC that Torrey had not patented an oven ventilation system at all but rather a backflow and autoignition prevention device.

In fact, Raytheon asserted before the CAFC (and before this Court now) that Roper should be estopped from arguing that the Torrey invention was an oven ventilation system, because, according to Raytheon, Roper did not argue that at the trial level. The CAFC, however, reviewed the record and made short work of Raytheon's "appeal estoppel" argument (B85-87):

> "Raytheon says Roper is precluded by an 'appeal estoppel' from contesting the inclusion of 'no backflow during autoignition' in all claims because Roper relied on 'no backflow' in the District Court and should not be allowed to change its theory on appeal. Examination of the trial record, however, reveals that Roper there stressed the theory it urges on appeal [that the invention is an oven ventilation system that works in all three modes without fouling the waveguide], and that it was *Raytheon* which

> argued that the 'essence' of Roper's invention was no backflow during autoignition.
>
> * * *
>
> * * * The unchallenged evidence established that Roper's ovens experienced no fouling or contamination. There is no basis in the record, therefore, for the imposition of an 'appeal estoppel' precluding Roper from reliance on the claims as written and allowed." (Emphasis in original.)

Indeed, if anyone has changed its theory on appeal, it is Raytheon. At trial Raytheon argued that Torrey had claimed two inventions: (1) an invention to prevent backflow during all autoignitions (claims 1, 3 and 4) (B29) and (2) an invention which prevents autoignition entirely (claims 1, 2, 5 and 7) (B29). This construction of the claims was the basis on which the claims were originally found by the trial court to lack any utility (B29).

During the appeal, as specifically noted by the CAFC, Raytheon abandoned its argument that claims 1, 2, 5 and 7 were for inventions to prevent autoignition (B87-88). Unfortunately for Raytheon, this left independent claims 2 and 5 unchallenged. So, for the first time, Raytheon now asserts that *all* the claims are for an invention to "prevent backflow during autoignition", while complaining that it is Roper which changed its position on the appeal.

Raytheon's argument on this point is not only meritless, as the CAFC's review of the entire record indicated, but in view of Raytheon's own change in its position, Raytheon is in a particularly poor position to assert the argument at all.

Conclusion

For the foregoing reasons, the petition should be denied.

Respectfully submitted,

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No. 83-2128.

In the

Supreme Court of the United States.

OCTOBER TERM, 1983.

RAYTHEON COMPANY,
PETITIONER,
v.
ROPER CORPORATION,
RESPONDENT.

Supplemental Brief under Supreme Court Rule 22.6 in Support of Petition for Writ of Certiorari.

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BATEMAN & SLADE, INC. BOSTON, MASSACHUSETTS

BEST AVAILABLE COPY

SUPPLEMENTAL BRIEF UNDER SUPREME COURT RULE 22.6 IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI,

Petitioner, Raytheon Company, in supplementation of its Petition for a Writ of Certiorari, hereby directs the attention of the Court to the following Petitions for Writs of Certiorari which are before this Court and which present issues the same as or closely related to the issues raised by Raytheon's Petition herein:

(1) Hazeltine Corp. v. RCA Corp., No. _____, filed July 5, 1984; and

(2) White v. Jeffrey Mining Machinery Co., No. 83-1913, filed May 22, 1984.

These cases involve impermissible fact-finding and abuses of Rule 52(a), F.R. Civ. P., by the Court of Appeals for

the Federal Circuit, the same court involved in the case at bar. Together with the present case, they show that Court of Appeals has embarked on a course which, if uncorrected, will deprive litigants of any meaningful trial for the resolution of the pervasive issues of fact which this Court has constantly reiterated are presented by patent disputes.

Respectfully submitted,

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Reply to Brief in Opposition to Petition for a Writ of Certiorari

and

Appendix C.

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BATEMAN & SLADE, INC. BOSTON, MASSACHUSETTS

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I. ROPER BOTH MISSTATES THE LAW ON OPERABILITY AND RELIES ON IMPERMISSIBLE FINDINGS OF FACT BY THE COURT OF APPEALS

A. Roper Avoids the Only Problem Asserted by the Patent to Have Been Solved by the Patented Invention

In its brief Roper raises a new issue not raised in the Petition for Certiorari, namely, safety of common cavity ovens (Opp. 1, 4, 5).[1] Roper relates such safety to the sole "general" object of the invention (Opp. 5, 8; App. A7, col. 1, lines 55-59) and attempts to justify the Court of Appeals' reversal of invalidity on the ground that the Roper oven is safe.[2] The District Court,

---

1. We cite the Roper brief in opposition as "Opp." together with the page number. Appendix C is bound in at the end of this brief.

2. The irrelevance of "safety" as a consideration is discussed below at pages 7-13.

however, understood that the only problem to be solved was backflow into the waveguide caused by autoignition during self-cleaning (App. B29, B35) as already set forth in the Petition (pp. 18-23).

The Court of Appeals accepted Roper's newfound theory and redefined the invention (App. B83), by reading the "general" object in vacuo (and not in the context of the entire specification) thereby disregarding both the fact that backflow prevention is the only problem the patent purports to solve and the District Court's express findings as to the nature of the invention.

B. The Clock That Ticked And The Oven That Backflowed

For over a century the courts of this country have followed the teachings of Mitchell v. Tilghman, 86 U.S. 287 (1873) that the "utility" which

must be possessed by a patented invention must be that which relates to the advance assertedly made by the invention. This principle is well illustrated in Amphenol Corp. v. General Time Corp., 397 F.2d 431 (7th Cir. 1968), in which the Court of Appeals for the Seventh Circuit found the invention there (an automobile clock assertedly free of audible ticking) invalid for lack of utility on proof that the clock did in fact audibly tick. There was no dispute that the clock otherwise performed all the functions of a clock, e.g., it did keep time. The court held:

> With reference to the aspect of utility, plaintiff's claimed useful improvement over prior art is the substantial reduction of tick noise. The Trial Judge found, as we do, from our study of the record, that the elements of the plaintiff's device which plaintiff asserts are not to be found in the prior art do not contribute to reduction of

> noise, better timekeeping or longer life as asserted during the trial. Such test data as was submitted did not prove that quieter operation was secured by, for example, telescoping of the helical connecting spring over the hubs of the wheel and pinion, or the space between the hubs. The "difference" between the teaching of the prior art does not qualify as invention if that difference lacks utility. It must be the feature which accomplishes the purpose set out in the specification. Imperial Stone Cutters, Inc. v. Schwartz, 8 Cir. 1966, 370 F.2d 425, 429, 152 USPQ 91, 94.

397 F.2d at 438 (emphasis added).

Here, the invention is assertedly an oven free of backflow, thereby permitting use of an open waveguide venting structure in a self-cleaning environment. As found by the Trial Court, the patented invention is not free of backflow and does not solve the purported problem (backflow into the open waveguide). Like the automobile clock, it operates for some purpose, but

not the purpose for which the patent was sought and was granted, and thus does not possess the requisite "utility". It is indeed a "noisy clock".[3]

In finding utility established by the sole "general" object in the instant case, the Court of Appeals sought to free itself of the constraints of Mitchell v. Tilghman by confining Tilghman to cases where the result to be achieved is explicitly set forth in each of the claims.

---

3. On page 6 of its brief, Roper states, with no record support, that the District Court held that the Roper oven "lacked all utility". Actually, the court held that the patented invention lacks the utility required by the statute in that it fails to "attain the result claimed by the inventor in his patent." (App.B44 -B46; see also App. B72-B73). Indeed all devices have some sort of utility. Even a bicycle that is incorrectly alleged to be a perpetual motion machine is useable as a bicycle.

This not only trivializes Tilghman and invites the kind of patent drafting one-upmanship described in our Petition, but also disregards this Court's admonition in United States v. Adams, 383 U.S. 39, 49 (1966), that one must look to the entire patent [including, as here, the express statement of the problem to be solved] to ascertain what the "invention" is.[4] It also rejected the guidance of this Court in Graham v. John Deere Co., 383 U.S. 1, 17 (1966), as to the particular importance of the factual assessment of the prior art in relation to the invention.

---

4. Significantly, Adams was totally ignored by Roper in its discussion of applicable law.

C. If the "General" Object is Construed Without Reference to the Remainder of the Patent, It Does Not Relate to a Problem Solved by the Roper Oven.

To the extent that one may interpret a "general" object without reference to the remainder of the patent, that object must show an advance over the prior art. Otherwise the object would be unrelated to any patentable invention and would be mere surplusage.

No advance was shown in the "safety" aspect, since none of the prior art ovens were found to be unsafe. The Trial Court did note that there appeared to be a minor problem with steam in prior ovens following microwave cooking; this, however, was based on a warning in GE and Litton oven manuals. (App. B10). The court was unaware that this same warning

appears in Roper's own manual.[5] Thus, the Roper oven is neither more safe nor less safe than the prior ovens in this regard.

Moreover, the Court of Appeals, on its own, without referring to any evidence and without the required deference to the Trial Court's findings

---

5. The District Court was unaware of Roper's warnings to its own customers. A copy of the manual furnished by Roper to purchasers of its ovens through Sears Roebuck, and provided to Raytheon during discovery, evidently had a page containing various warnings removed from it prior to production. The absence of that page was undetectable, since Roper had imprinted consecutive Bates Stamp numbers on the preceding and following pages. Raytheon relied on that manual in preparing its case for trial and only recently discovered the warning while reviewing another manual produced by Roper as representative of those furnished to purchasers of the "Roper" brand ovens. We have included at App. C18 excerpts from the page that contains that warning, along with others.

of fact, made its own findings as to the "general" object, including the terms "useable in all three modes," "safe" and "violent explosion" therein. In particular, it found as fact that the oven was "useable in all three modes of operation", as it interpreted that phrase, despite the fact that the District Court found that Roper's invention was not useable to prevent backflow in the self-cleaning mode.6 Thus, it ignored the fact findings of the Trial Court, and substituted its own findings, all in contravention of Rule 52(a), Fed. R. Civ. P.

Additionally, the Court of Appeals implicitly found that "violent

---

6. According to the Roper patent, an oven that exhibits backflow is not "useable". (App. A7, col. 1, lines 6-25).

explosions" means dangerous explosions and expressly found that the Roper oven is free from such explosions. (App. B88-B89, B91-B92). The inventor himself refuted this finding in testifying in response to questions from the District Court that violent explosions are to be expected (App. C13) and that they do not present a safety problem (App. C14-C15).[7]

---

7. Lest the Court be misled by Roper's discussion of "violent explosions" (Opp. 4), we note: (a) even during normal operation of the Roper oven, pressures of 10 pounds per square inch are not uncommon during autoignition (App. C4-C5); (b) this produces a force of over 3,000 pounds on an oven door, obviously much more than enough to blow open the door; and (c) the door is latched during self-cleaning to prevent this from happening. (App. C11, C17). Moreover, the only reference in the record to "buckling" of the oven floor, relates to downward deflection of the oven floor in response to such pressures (App. C17), as was shown to occur in the Roper oven.

To the extent that the Roper oven limits the severity of explosions, it does so by limiting air flow. However, Roper admitted to copying this technique from the prior art (App. C6-C8), including Roper's own prior self-cleaning oven (App. C8). The District Court explicitly found that this was an old technique (App. B12) and this finding was ignored by the Court of Appeals to the extent that that court found the "general" object to relate to an advance over the prior art. This exemplifies the mischief that results from an appellate court's intervention into the fact-

---

7. (Continued) As to "fires" in the ovens during self-cleaning, we note that Roper refers only to a "finding" by the Court of Appeals (App. B64). And, there was no evidence that such "fires" present safety problems in an oven made to withstand a self-cleaning temperature of 900°F.(App. A9, col.1, lines 12-15; C15).

finding function of the trial court.[8]

The Court of Appeals' approach invites sharp patent practice, e.g. the posing of bogus objects in order to rescue patents that are otherwise invalid for failing to deliver on their promises. Thus, a patent on an improved automobile engine might make wild, unsupportable claims to improved performance, but avoid invalidity by including as one of its objects the ability to run on gasoline, even though every engine already on the market meets this criterion.

This Court should instruct the Court of Appeals that it may not uphold the operability of a patent under

---

8. Indeed, the Court of Appeals ignored unstated, but implicit, findings which the District Court made in reaching the conclusion that the patented invention relates only to backflow prevention.

35 U.S.C. § 101 and § 112 merely because it meets an object set forth in the patent unless that object has been found as a matter of fact to relate to a patentable distinction over the prior art.

II. ROPER MISREADS THE LAW RELATING TO ESTOPPEL

In the Petition (pp. 25-32) we have treated the law relating to the utility issue in this case. We stand on our analysis of the prior decisions there cited. We shall, however, reply to Roper's citation of other cases in support of its estoppel position. (Opp. 10).

A. Roper's Arguments To The Contrary, The Cases Cited by Roper Do Not Create a Doctrine of Infringer Estoppel to Deny Utility

None of the cases cited by Roper would require the imposition of

estoppel against Raytheon in the instant case. Lehnbeuter v. Holthaus, 105 U.S. 94 (1881), was discussed in the Petition (p. 42). In none of the other Supreme Court cases cited by Roper (Opp. 10-11) did this Court refuse to consider evidence of inoperability because the defendant had been held to infringe.

This is true also of the lower court decisions cited by Roper (Opp. 11). In E.I. duPont de Nemours & Co. v. Berkley & Co., Inc., 620 F.2d 1247 (8th Cir. 1980), the court did in fact weigh the facts relative to utility (620 F.2d at 1258-60), although it found, inter alia, that the defendant was taking advantage of the very feature which it had alleged to lack utility. Here, in contrast, Raytheon's oven lacks the very same utility (backflow prevention) which it has always asserted to be absent from

the patented device as well. Additionally, in both Tapco Products Co. v. Van Mark Products Co., 446 F.2d 420 (6th Cir. 1971), and Miller v. Daybrook-Ottawa Corp., 291 F. Supp. 896 (N.D. Ohio 1968), the courts actually weighed the evidence of non-utility and found it insufficient.

B. Actually, The Prior Decisions Negate Any Estoppel To Deny Operability

The cases on point in fact support Raytheon's position, not Roper's. (See Pet. at 42-47.) In Amphenol Corp. v. General Time Corp., supra at 3, the patent would have been infringed if valid (397 F.2d at 433,39) but was invalidated for inoperability. See also H.C. Baxter & Bro. v. Great Atlantic & Pacific Tea Company, 236 F. Supp. 601 (D. Me. 1964), aff'd on other grounds 352 F.2d 87 (1st

Cir. 1965). Consequently, Roper's asserted estoppel is hardly a "uniformly followed" rule; indeed, although it is sometimes paid lip service, it is rarely, if ever, applied.

III. THE WEAKNESS OF ROPER'S POSITION IS UNDERSCORED BY ITS NUMEROUS MISSTATEMENTS OF THE RECORD

We respond here to several distortions in the Roper Brief, lest this Court believe that we acquiesce in them.

On page 5 of its Opposition, Roper asserts, entirely contrary to fact, that Raytheon has never denied that the Roper oven (1) ventilates properly in all three modes, (2) exhibits no waveguide fouling and (3) is free of violent explosions. Actually, Raytheon has always asserted that the Roper oven fails to suppress backflow. This is the same as saying that it fails to ventilate properly and

to prevent waveguide fouling (supra at p. 17). Raytheon has certainly alleged that the Roper oven is subject to waveguide fouling and, indeed, introduced testimony to that effect. (App. B33, B34). The District Court found that the fouling is not "discernible or significant" (App. B35, B36) simply because of the infrequent occurrence of self-cleaning, but not because of anything done by Roper to prevent or effectively resist the backflow which creates fouling. (App. B34).

Contrary to Roper's assertion on page 6 of its Brief, the Raytheon project was not "floundering" because of any steam problem. As the District Court found, the engineers working on the oven did not believe that steam was a real problem (App. B14-B15). Even Mr. Torrey, the Roper inventor, was unconcerned about

steaming (App. C19). And General Electric maintained its prior art ventilation system through three successive models, even after the appearance of the Roper oven (C9).

Again on page 6, Roper quotes the District Court as stating that the Raytheon tests on the Roper and Raytheon ovens were "not typical of normal use", but fails to inform this Court of the remainder of the trial court's finding, namely, that the tests "were all within the capabilities of the oven and, therefore, were a fair test for the presence of backflow and waveguide fouling." (App. B32).

Contrary to the assertions on pages 5 and 10 of Roper's brief, Raytheon has never denied that the Roper oven is useable for some purposes. Raytheon does, however, deny that the patented

invention has utility for the purpose for which the patent was granted (35 U.S.C. § 101) and that the Roper patent teaches how to make an oven providing the advantages ascribed to the invention (35 U.S.C. § 112).

On page 14 of its Brief, Roper asserts that Raytheon asserted one theory of claim construction to the District Court and a second one to the Court of Appeals. This is entirely untrue. Indeed, Roper's "record support" for this distortion is the opinion of the District Court (App. B29) relating to the claims in question, which opinion nowhere refers to a position taken by Raytheon.

Further along the same page Roper asserts, again falsely, that Raytheon did not assert before the Court of Appeals that claims 2 and 5 require the suppression of autoignition. In

refutation, we refer this Court to App. C2-C3.

CONCLUSION

Roper has utterly failed in its multi-faceted attempt to support the decision of the Court of Appeals. The fact remains that the decision below is mischievous and will, if not reversed, promote deception on the Patent and Trademark Office, deprive litigants of the right to a meaningful trial, and result in undesirable and far-reaching changes in both the Patent Law and in the conduct of patent prosecution and litigation.

This Court, therefore, ought to issue the Writ of Certiorari requested by Petitioner.

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Appendix C

APPENDIX

VOLUME C

Excerpt From Page 43 of Raytheon's Main Brief Before the Court of Appeals.....C2

Deposition Transcript of Sumner H. Torrey (Selected Parts).....C4

Stenographic Transcript of Trial (Selected Parts).....C6

Excerpts From Second Page of Roper User's Manual Titled: "Use and Care of Your MICROWAVE COMBINATION RANGE".....C18

Torrey Memorandum, "Common Cavity Cooker Summary".....C19

EXCERPT FROM PAGE 43 OF RAYTHEON'S MAIN BRIEF BEFORE THE COURT OF APPEALS:

B. Raytheon's Oven Does Not Employ Air Flow Below the Level Which Is Capable of Producing Explosive Reactions With The Products of Thermal Decomposition.

Roper's claims 1, 2 and 5 expressly require air flow which prevents the occurrence of autoignitions. Such autoignitions are or bring about the "explosive reactions" which Roper claims to have prevented. (R.A. 742-43). Claims 3 and 4, when construed in light of the specification as they must be, United States v. Adams, 383 U.S. 39, 49, 148 U.S.P.Q. 479, 482 (1966), must also be read to imply such limitations, as infringement requires the use of the

essence of the disclosed invention. Eastern Electric v. Seeburg Corp., 164 U.S.P.Q. 97, 104-05 (S.D.N.Y. 1969), citing Westinghouse v. Boyden Power Brake Co., 170 U.S. 537, 568-69 (1898). Claims "cannot be given a construction broader than the teachings of the patent as shown by the drawings and specification." Marvin Glass & Assoc. v. Sears Roebuck and Co., 448 F.2d 60, 171 U.S.P.Q. 263, 265 (5th Cir. 1971).

Manifestly, autoignitions do occur in Raytheon's oven, as shown by the tests discussed in the decision of the court below, and elsewhere in this brief. Consequently, Raytheon does not infringe.

DEPOSITION TRANSCRIPT OF SUMNER H. TORREY
Exhibit 264
(Page 99, line 22 to page 100, line 23)

Q. I'm going to refer you now to the 520 patent, that is, Exhibit 4. Would you please turn to Column 11, and beginning on Line 15 there is a reference to a slightly positive pressure this caused, creating backup of heated air.

A. I see it.

Q. Now, is that the same as the term "auto ignition pressures" that is used on Line 44?

A. (Examining document) I believe it would have to be. There is nothing else that creates positive pressure.

Q. When you refer to auto igniton pressures, what range of

pressures are encountered during the phenomenon of auto ignition?

A. Auto ignition? As I attempted to indicate this morning, that is extremely difficult to measure, but it can be done theoretically. It is on the order of 50 to 70 percent above atmospheric pressure.

Q. Well, if atmospheric pressure is 15 pounds per square inch, approximately, then the auto ignition pressures would be around 7 1/2 to 10 or 11 pounds; is that correct?

A. Yes.

Q. That is a fairly substantial pressure inside of an oven, isn't it?

A. It is.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 5, page 51,
line 9 to
page 52, line 25)

Q. Going to Column 6, Line 8:

"During thermal cooking, when the blower is turned off, the fact that the openings 85, 87 and 88 in the housing 51 are in a 'low' position, below the bottom of the cavity, the fact that the waveguide 52 feeds air inwardly at the bottom of the cavity, and the fact that the vent 162 is in a 'high' position at the top of the cavity, provides sufficient convection, on the order of 0.5 to 2.0 CFM., depending

upon temperature, for both baking and self-cleaning operations."

Now, that was the convected air flow rate in the prior MXV ovens, was it not?

A. It fell within that range, I believe. I'm not absolutely sure of that.

Q. And directing your attention to Column 14, Claim 7, Line 39 calling for: "...to reduce the flow of convected air under baking and self-cleaning conditions to within the range of 0.5 to 2 C.F.M."?

A. Is this Column 7?

Q. Column 14, Line 39.

A. Okay -- Line 39?

Q. Line 39.

A. Yes.

Q. The convected air flow rate.

A. And you are reading really Claim 7, right?

Q. That's correct.

A. The question is?

Q. That's the same convected air flow rate that's referred to at Column 6 beginning at Lines 8 and specifically appearing at Line 14 of Column 6.

A. Yes.

Q. And that's within the range of the air flow rate that existed in the prior MXV oven?

A. That range, yes.

Q. And it was chosen to match the air flow rate of the prior MXV oven?

A. Yes.

TRIAL TRANSCRIPT
WITNESS: KIRSCHKE
(Vol. 6, page 34,
line 18 to
page 35, line 1)

Q. What was the name of the General Electric common cavity range?

A. When we first introduced the common cavity range, it was known as the Versatronic.

In 1973, a second major revision was introduced and it was identified as the Super Stove.

After I left General Electric, in 1980, they brought out another version which is now known as the Time Maker.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 67,
line 13 to
page 69, line 2)

Q. Now, your patent talks about, again, in the claims, "limiting the amount of air into the waveguide to prevent explosive reaction."

You've heard that language?

A. Yes, I have.

Q. What's that talking about?

A. That, basically, describes the hazards that relate to extreme soils and UL tests and is essentially covered by prior art in the Lewis patent.

Q. And is that the purpose of having a smaller gap in the bottom of the door in a normal self-cleaning oven?

A. The purpose for having the smaller gap, I believe, in the bottom of

an oven door or GE technique by Lewis which is entering near the oven bottom, is to limit the amount of air, so that you don't have extreme reactions during extreme load tests. This can be combustion and a small explosion.

My experience has taught me it has sufficient force to lay that door down flat if the door is not latched.

It is really an explosion where the force sends the air out in all directions within the oven. The oven attempts to contain this, and you try to get that through the smoke eliminator, but in the case of UL loads, they are very severe, and it is not their intended purpose for testing the oven that way. It's to look for hazards.

Q. Let's go back to your invention. You are now getting back into talk of explosive reactions.

Earlier you talked about autoignition and fouling. Let me ask you: Does your patent teach that it eliminates what is known as autoignition?

A. No, it does not.

Q. Does autoignition occur even after you put in your patented invention into the oven?

A. It can occur; it can occur under normal self-cleaning methods occasionally, soil loads occasionally. It can occur under severe soil loads. I know it occurs under severe and extreme soil loads.

TRIAL TRANSCRIPT
WITNESS: TORREY
(Vol. 2, page 87, line 4 to
page 88, line 14

THE COURT: Has there ever been a violent explosion from air forced into a self-cleaning mode? Has there ever been?

THE WITNESS: Yes, your Honor. It's primarily a function of oven loads. The claim language we're talking about is distinguishing between what I'll call normal autoignition in the home and a more severe load case relative to, say, a heavier load that could cause a more violent reaction.

On the other hand, an extreme load such as pans being left in the oven inadvertently or the like, that would tend to make a much more severe reaction.

THE COURT: What I'm trying to say, reaction I can see. If it's a dirty oven, I can see that it might even flame or burn or smoke, but now you're talking about an explosion.

Is there ever a time when this air coming through there can cause an explosion?

THE WITNESS: Perhaps I better just define what I mean by "explosion" and what I mean the patent means.

It's a rapid expansion of the gases in the oven. Under extreme load conditions, if the oven didn't have a latch, it could just open the oven door and lay it down flat which would let oxygen in and make things worse.

So I use the word, the patent uses the word "violent explosion" from the standpoint of rapidly expanding gas which develops pressure.

In all of these cases, it prevents the fouling of the waveguide.

THE COURT: We are not talking about a life-threatening explosion?

THE WITNESS: Not from the standpoint of the range blowing up, per se.

TRIAL TRANSCRIPT
WITNESS: BOHDAN HURKO
(Vol. 8, page 39, line 10 to page 40, line 5)

Q. How do you detect an autoignition?

A. Well, there is several manifestations of ignition. The first is on the curve of temperature rate, there will be a sudden spike.

Q. You measured the temperature within the oven?

A. Yes.

And a sudden increase and drop. And then, also, as a result of the temperature increase and burning of the products, there will be a sudden increase of the pressure. And this could be observed by two things:

One, the pressure will go in every direction. So you can observe that the oven bottom is flexing.

THE COURT: Say that again.

THE WITNESS: Oven bottom is flexing, it goes into down.

And then if you do not have a good locking system like we had in the initial development, door will be opened, because there is enough pressure to make this door open.

EXCERPTS FROM SECOND PAGE OF ROPER USER'S MANUAL TITLED:

"Use and Care of Your MICROWAVE COMBINATION RANGE"

In accordance with government regulatory requirements, the Rules for Safe Operation listed below have been provided to help you, the user of this cooking appliance, become more familiar with the possible hazards associated with operating an appliance and the proper precautions to avoid such hazards. Therefore, please take the time to carefully read and understand these Rules for Safe Operation.

Rules for Safe Operation

*

*

* Use care when opening oven door to let hot air or steam escape before removing or replacing food.

*

*

TORREY MEMORANDUM, "COMMON CAVITY COOKER SUMMARY", JAN. 1, 1975, TRIAL EXHIBIT 111 AT 1427

"Due to oven size, tests show that pure microwave steaming is not a concern, therefore no special air flow is necessary. Condensation on a door window will occur, and this might be reduced by forced flow." (emphasis added)

Office-Supreme Court, U.S.
FILED
SEP 10 1984
ALEXANDER L. STEVAS,
CLERK

No. 83-2128.

In the

Supreme Court of the United States.

OCTOBER TERM, 1983.

RAYTHEON COMPANY,
PETITIONER,

v.

ROPER CORPORATION,
RESPONDENT.

Second Supplemental Brief under Supreme Court Rule 22.6 in Support of Petition for Writ of Certiorari.

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BEST AVAILABLE COPY

SECOND SUPPLEMENTAL BRIEF UNDER SUPREME COURT RULE 22.6 IN SUPPORT OF PETITION FOR WRIT OF CERTIORARI

Petitioner, Raytheon Company, in supplementation of its Petition for a Writ of Certiorari, hereby directs the attention of the Court to the following additional Petitions for Writs of Certiorari which are before this Court and which present issues the same as or closely related to the issues raised by Raytheon's Petition herein:

(1) Envirotech Corp. and Energy Fuels Nuclear, Inc. v. Amstar Corp., No. 84-294, filed August 24, 1984;

(2) Rohm & Haas Co. v. Crystal Chem. Co., No. 84-1, filed July 5, 1984;

(3) W.L. Gore & Assocs. v. Garlock, Inc., No. 84-2, filed July 2, 1984, and

(4) T.P. Labs., Inc. v. Professional Positioners, Inc., No. 83-1939, filed April 21, 1984.

In these cases, the Court of Appeals for the Federal Circuit has followed the same path it traveled in the cases cited in our previous Supplemental Brief: it has engaged in impermissible fact-finding in abuse of Rule 52(a), F.R. Civ. P. The companion cases show that the court's disregard of Rule 52(a) in the instant case is not a mere aberration but rather a course of conduct which, unless curtailed by this Court, will continue to impose a standard of review in patent cases sharply different from that specified by Rule 52(a) and by prior decisions of this Court.

Because of the Federal Circuit's predilection to usurp the fact-finding functions of the District Courts and

because of the other issues of major impact on the patent system raised in Raytheon's Petition for Certiorari, this case is particularly appropriate for review by the Supreme Court. In any event, should this Court grant any of the other pending Petitions for Certiorari cited by Raytheon, Petitioners request that the present case be consolidated with the other cases or held pending this Court's decision in the other cases.

Respectfully submitted,

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